

**2003 Performance Report
General Chemistry and
Microbiology Section**

May 2004

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2003 PERFORMANCE REPORT
GENERAL CHEMISTRY AND MICROBIOLOGY SECTION

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Laboratory Services Branch

Ontario Ministry of the Environment

May 2004

INTRODUCTION

The General Chemistry and Microbiology Section (GCMS) is part of the Ministry of the Environment's Laboratory Services Branch. The section is comprised of two units, the Water Chemistry and Microbiology Unit. The Water Chemistry Unit identifies and provides quantitative analysis for major ions, nutrients, and physical properties in a variety of matrices. The Microbiology Unit identifies and enumerates indicator bacteria of water and waste waters.

This report provides a brief outline of the analytical quality control (QC) program associated with sample analysis and examines 2003 performance data for each test in the Water Chemistry and Microbiology Units. GCMS strives to maintain a high standard of analytical performance through its quality assurance program. QC is an integral part of this process.

A number of changes have taken place in the General Chemistry and Microbiology Section since the 2002 performance report was issued. The following describes those changes.

METHOD ADDED BY GCMS IN 2003

Bromate / Bromide (E3434)

Table of Contents

1.0 Performance Report Format	1
2.0 Analytical Quality Control Program, Chemistry	4
2.1 Performance Summaries, Chemistry	7
Alkalinity Total Fixed Endpoint (E3218)	8
Bromate (E3434)	11
Bromide (E3434)	14
Carbon, Dissolved Inorganic (E3370)	17
Carbon, Dissolved Organic (E3370)	20
Chloride (E3004)	23
Chloride (E3013)	29
Chloride (E3016)	33
Chlorophyll "a" (E3169)	36
Chlorophyll "a" Acidified (E3169)	40
Chlorophyll "b" (E3169)	42
Colour, True (E3219)	44
Conductivity (E3218)	47
Cyanide, Free (E3015)	50
Cyanide, Total (E3015)	54
Fluoride (E3172)	58
Nitrate (E3004)	61
Nitritotriacetic Acid (E3406)	67
Nitrogen, Ammonia Plus Ammonium (E3364)	70
Nitrogen, Ammonia Plus Ammonium (E3366)	73
Nitrogen, Nitrate Plus Nitrite (E3364)	76
Nitrogen, Nitrate Plus Nitrite (E3366)	79
Nitrogen, Nitrite (E3364)	82
Nitrogen, Nitrite (E3366)	85
Nitrogen, Total Kjeldahl (E3116)	88
Nitrogen, Total Kjeldahl (E3118)	93
Nitrogen, Total Kjeldahl (E3367)	98
Nitrogen, Total Kjeldahl (E3368)	101
Oxygen Demand, Biochemical (E3182)	104
Oxygen Demand, Chemical (E3170)	108
Oxygen Demand, Chemical (E3246)	112
pH (E3218)	116
Phenolics, Reactive (E3179)	119
Phosphorus, Reactive ortho-Phosphate (E3364)	122
Phosphorus, Reactive ortho-Phosphate (E3366)	125
Phosphorus, Total (E3116)	128
Phosphorus, Total (E3118)	133
Phosphorus, Total (E3367)	138
Phosphorus, Total (E3368)	141
Silicon, Reactive Silicates (E3370)	144
Solids, Dissolved (E3188)	147

Table of Contents cont'd

Solids, Suspended (E3188)	150
Solids, Suspended Ignited (E3188)	153
Solids, Total (E3188)	157
Solids, Total Ignited (E3188)	160
Sulphate (E3004)	164
Sulphate (E3013)	170
Sulphate (E3172)	173
Sulphide (E3100)	176
Turbidity (E3311)	179
 3.0 Microbiology	 182
3.1 Quality Control Program, Microbiology	183
3.2 Performance Summaries, Microbiology	185
<i>Escherichia coli</i> (EC) (E3226)	186
<i>Escherichia coli</i> (EC) (E3371)	188
<i>Escherichia coli</i> (EC) (E3407)	190
FECAL STREPTOCOCCI (FS) (E3371)	192
HETEROTROPHIC PLATE COUNT (HPC) (E3408)	194
INDICATOR ORGANISMS (E3226)	196
<i>Pseudomonas aeruginosa</i> (PSA) (E3371)	197
TOTAL COLIFORM (TC) (E3226)	199
TOTAL COLIFORM (TC) (E3371)	201
TOTAL COLIFORM (TC) (E3407)	203
 Bibliography	 205
Abbreviations	206
Appendix A	208

1.0 PERFORMANCE REPORT FORMAT

The parameters are those analysed by the GCMS for 2003.

The performance report is organized alphabetically according to test name (eg. Dissolved Organic Carbon is filed under the heading "Carbon, Dissolved Organic") and second, by the method reference number. Detailed information concerning the format of each page is outlined below:

1.1 TEST DESCRIPTION

<u>TITLE:</u>	The name of the test parameter.
<u>IDENTIFICATION:</u>	
Laboratory	Location where the test is performed.
Method Reference No:	A number assigned by the Quality Management Unit to an analytical test method eg.(E3370).
Product Code:	LIMS code for analysis request.
Sample Type/Matrix:	The various sample types that can be routed to the method.
Method Introduced:	Date that the method was implemented at the laboratory.
Reporting Units:	Unit of measurement in which the results are reported.
Supervisor:	Name of supervisor/manger responsible for the method.

SAMPLING:

The type of container and preservative (if applicable) that is used and minimum volume of sample that is usually required. Any sample preparation that is normally performed in the field, is also indicated (1).

SAMPLE PREPARATION:

Sample preparation techniques which are usually performed at the laboratory before analysis.

ANALYTICAL PROCEDURE:

Brief summary of the analytical method used to determine the parameter.

INSTRUMENTATION:

Type of instrumentation used to perform the test. Examples: Automated continuous flow systems consist of a sampler, peristaltic pump, manifold for reagent addition, detection system and readout system. Microcomputers are used to control the operation of analytical equipment and/or data acquisition.

REPORTING:

W and T are method attributes that can be used to qualify low level data (2). A value reported with the qualifier $\leq W$ indicates no measureable response was observed under the conditions of the test and the value accompanying the remark is the lowest reportable value of the method. A value reported as $< T$ is interpreted as a measureable trace amount of the constituent, but under the conditions of the test are not satisfactorily verifiable. Interpret data with caution. When dilutions are required, WE and TE are used as data qualifiers to indicate the smallest measureable amount (W) and the limit of reliability (T) respectively has increased proportionately to the level of dilution.

To provide a consistent LSB approach to data reporting, GCMS calculates W from the standard deviation of duplicates (S_2), near zero, by rounding down to the nearest 1, 2 or 5 digit (4). T is five times W. The latest calculations, valid at date of publication for W and T values of all active methods, are contained in this report (APPENDIX A).

Data is reported to a maximum of three significant figures, down to the W value.

CALIBRATION:

The number of standards used to calibrate the analytical system plus blanks if applicable.

CONTROLS:

The calibration, drift, recovery, and interference controls that are used when applicable to ensure that the system is operating properly.

MODIFICATIONS:

Modifications made to the test in 2002.

NOTES:

Explanatory notes which may aid the data user in interpreting results and information.

1.2 PERFORMANCE DATA SUMMARY

QUALITY CONTROL DATA FROM/TO: (Optional)

The period of time over which data were collected.

ANALYTICAL RANGE AND REPORTING UNIT:

The full scale value for the analytical range is given in concentration units.

CALIBRATION CONTROL:

Calibration control includes a table outlining the number of data collected over the selected time period, expected concentrations of the control standards, the calculated mean concentration of these standards, mean bias (mean concentration minus the expected concentration), and standard deviations of each control standard. The between run standard deviation (S), the within run standard deviation (S_w), the ratio S/S_w , and the historical control limits for standards sums and differences are provided.

RECOVERIES (Where applicable):

The table outlines the number of data collected over the selected time period, expected concentrations of the recovery standards, the calculated mean concentration of these standards, and standard deviations of each recovery standard.

DUPLICATES:

The table outlines within run duplicate data collected over the selected time period. Data are sorted into a number of concentration spans. The standard deviation for duplicates is provided for each range. The coefficient of variation (%) is determined by dividing the mean standard deviation (S_2) for a particular concentration span by the mean concentration of duplicate results in that span and multiplying by 100.

OTHER CHECKS (Where applicable):

The table outlines the number of data collected over a selected time period, the calculated mean concentration of ie., blank, and standard deviation.

1.3 QUALITY CONTROL GRAPHICS

CALIBRATION CONTROL:

Calibration control standards sums and differences are plotted on a horizontal scale for the period of data collection (referred to on the graphs as "QUALITY CONTROL STANDARD A+B" for example). The vertical scale consists of the warning/control limits expressed on either side of the expected value. These limits were chosen from analytical performance data.

NOTE:

DATE FORMAT:

mm/dd/yy

2.0 ANALYTICAL QUALITY CONTROL PROGRAM

Quality control is a continuous process that involves constant checks of sample processing procedures. This report summarizes the QC data collected during analytical processing to monitor performance of the analytical system.

Calibration Standards are verified for identity, purity and concentration accuracy by comparison against independent sources wherever possible. Usually, a series of calibration standards are analyzed covering the analytical range.

Once a system has been calibrated, quality control begins. Depending on the analytical procedure, quality control may be used to evaluate: calibration, blank, recovery, sensitivity, potential interference, and sample repeatability.

Calibration and Blank

Calibration is controlled by a minimum of two quality control standards and a long term blank which are prepared and maintained independently of the calibration standards. The system is not calibrated with the quality control standards. The long term blank is Pure De-ionized Water (Pure-DW) used to prepare the quality control standards and has zero concentration of the target analyte. Control standards are prepared less frequently than calibration standards, thus allowing an independent cross check of the newly prepared calibration standards. When control standards are prepared, they are checked over three consecutive runs and must be within limits (two standard deviations of theoretical value) before routine use.

The standard deviation of the control standards is used to estimate the between-run standard deviation (S) and is compared against the within-run standard deviation (S_w). If the ratio S/S_w exceeds 1.5 then poor control of systematic error can be inferred (3). Values for S and S_w are calculated as follows:

$$2S^2 = (S_A)^2 + (S_B)^2 \qquad 2S_w^2 = (S_{A-B})^2$$

Where

S_A = standard deviation (s.d.) of control standard A

S_B = s.d. of control standard B

S_{A-B} = s.d. of the difference between control standards A and B

NOTE: If a second range is employed for a test, more control standards are used because, in many systems, the between-run standard deviations are concentration dependent.

Detailed description of the quality control processes are outlined in several LSB documents (2)(4)(5) and (6).

Control/Warning Limits

The control standards data are assessed and compared against the control/warning limits established from previous data to determine whether the calibration process is in control. The limits are set up initially based on method performance(4), and are reviewed when method and/or performance data reviews are conducted to determine if modifications are required based on historical data calculations. Control limits are calculated for the sums and differences of control standards (A,B,C,D) by the equations:

$$(A+B) \pm 4(S_{A-B}) \text{ for the sum of A+B}$$

$$(B+C) \pm 4(S_{B-C}) \text{ for the sum of B+C}$$

$$(C+D) \pm 4(S_{C-D}) \text{ for the sum of C+D}$$

$$(A-B) \pm 3(S_{A-B}) \text{ for the difference of A-B}$$

$$(B-C) \pm 3(S_{B-C}) \text{ for the difference of B-C}$$

$$(C-D) \pm 3(S_{C-D}) \text{ for the difference of C-D}$$

Note: Warning Limits are calculated by the same formulae above (using ± 2 instead of 4 and 3 respectively).

If a control limit is exceeded, the analysis is stopped, and corrective action is taken.

Recovery

Some methods require sample pre-treatment, such as digestion or extraction. A recovery check, suitable to that method, is required to estimate the efficiency of the pre-treatment. Recovery standards are usually prepared at 0%, 20% and 80% of full scale. The solutions are analysed in the same manner as routine samples. Although these solutions are not used to calibrate the instrument and corrections for the blank are calculated and applied if necessary. For an analytical run to be accepted, the recoveries should be within $\pm(5\% + T/2)$ of their expected values. (See Section 1.1 "Reporting" for T determination). The average blank should be within three standard deviations of its historical mean. If a second range is employed for a test, at least one additional recovery standard is used.

Sensitivity and Baseline

Any change in the sensitivity of the instrumentation is monitored periodically during the run, as defined by the method, by analysing a standard that is usually 80% of full scale, and comparing the reading to the original calibration standards. Baseline drift is usually recorded by periodic analysis, as defined by the method, of Pure-DW which does not contain any of the analyte, but may be treated to correspond to sample pre-treatment.

Interference

The interference check is run on any test where a substance may be present in concentrations that affect the results. The check is carried out near the threshold concentration of the interfering substance, beyond which the methodological safeguards used to minimize the interference are no longer effective. The check indicates that the interference has no effect up to the specified concentrations.

Sample Repeatability

Generally, one sample out of twenty is analysed in duplicate up to a maximum of three duplicates per analytical run. The samples are selected for non-adjacent, within-run duplicate analyses. By analysing samples in duplicate, the ability of the analyst to obtain repeatable analytical results, within an analytical run, can be determined. For results to be acceptable, at least two of the three duplicate pairs must conform to limits that are set based on historical performance.

Duplicate data are accumulated and usually sorted into 3 ranges of 0-10 or 0-20, 21-50, 51-100 percent of full scale. More ranges may be added where the analytical scale spans are greater than 2 log scales. When less than 3 data pairs are collected, the remark N.A. (not available) is reported. A standard deviation is calculated for each concentration range. The algorithm differs from the conventional standard deviation as follows:

Conventional Std. Dev. (1)* $S_1 = \sqrt{\frac{\sum_{i=1}^n (\bar{x} - x_i)^2}{n-1}}$	Std. Dev. of Duplicates (2)* $S_2 = \sqrt{\frac{\sum_{i=1}^{n'} (x_{1i} - x_{2i})^2}{2n'}}$
--	--

* Standard deviations used for the data summaries.

Where

- S_1 = sample standard deviation
- S_2 = duplicate difference standard deviation
- n = number of data
- $\bar{x}$ = mean of data
- x_i = i^{th} result
- $(x_1 - x_2)_i$ = difference of the i^{th} duplicate
- n' = number of duplicate pairs

The standard deviation (S_2) of the duplicate difference is also expressed as the coefficient of variation (CV).

$$CV = \frac{S_2}{\bar{X}} \times 100$$

2.1 PERFORMANCE SUMMARIES

ALKALINITY, TOTAL FIXED ENDPOINT

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	09/07/80
Method Reference No.	E3218	Reporting Unit	mg/L as CaCO ₃
LIMS Product Code	PHALCO3218	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Effluent, Industrial Waste, Raw Sewage, Drinking Water, Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or Plastic

ANALYTICAL PROCEDURE:

Samples (20.0 mL) are titrated with 0.02 N sulphuric acid to pH endpoint of 4.5. The titrant delivery rate is determined from the slope of the titration curve and the stability of the pH reading following each aliquot of titrant. pH, and conductivity are determined simultaneously.

INSTRUMENTATION:

Automated modular titration system with computer control and data processing software.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.5	Current T value: 2.5
--------------------------------	----------------------	----------------------

STANDARDIZATION:

Titrant, 0.02N sulphuric acid, is standardized.

CONTROLS:

Standardization and checks	BL plus 4 standards, e.g. QCA
Drift	In run standards throughout the run (tap water diluted to 50% V/V)

NOTES:

May '97 the W value was changed from 0.2 to 0.5 after a review of 2 years low level duplicate data '94-95.

ALKALINITY, TOTAL FIXED ENDPOINT (E3218)

QUALITY CONTROL DATA FROM 01/08/03 TO 12/29/03

Analytical Range: to 1000 mg/L as CaCO₃

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	110	250	249.66	-0.34	2.1453
B:	110	100	99.86	-0.14	0.9351
C:	110	25	25.05	0.05	0.5204
D:	110	2.5	2.46	-0.04	0.1302
A+B:		350	349.52	-0.48	2.7759
A-B:		150	149.79	-0.21	1.8052
B+C:		125	124.92	-0.08	1.1052
B-C:		75	74.81	-0.19	1.0410
C+D:		27.5	27.52	0.02	0.5307
C-D:		22.5	22.60	0.10	0.5582

s.d.(AB)	S(between runs): 1.65	Sw(within run): 1.28	S/Sw: 1.3
s.d.(BC)	S(between runs): 0.76	Sw(within run): 0.74	S/Sw: 1.0
s.d.(CD)	S(between runs): 0.38	Sw(within run): 0.39	S/Sw: 1.0

On any given day the calibration is accepted if the calibration control values obtained lie within the ranges:

343	-	357	for	A+B
144.75	-	155.25	for	A-B
121.5	-	128.5	for	B+C
72.4	-	77.6	for	B-C
25.82	-	29.18	for	C+D
21.24	-	23.76	for	C-D

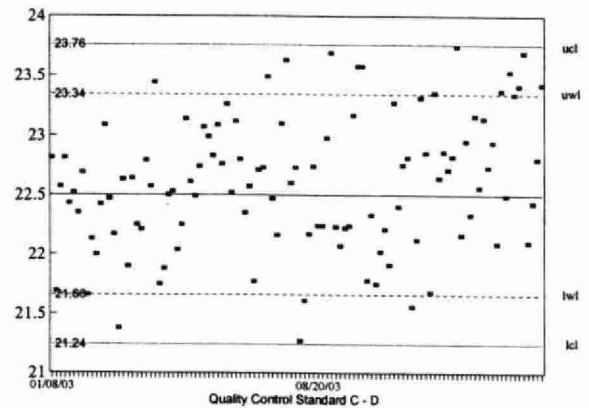
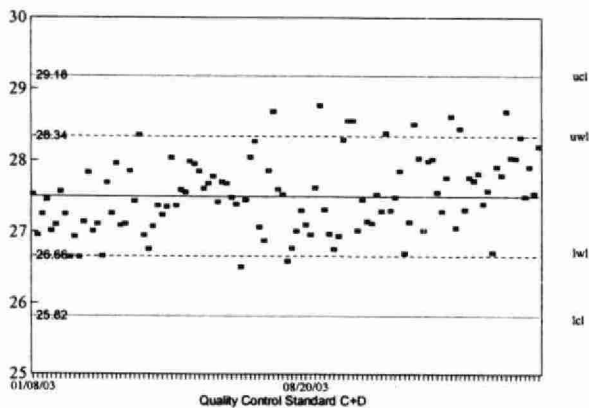
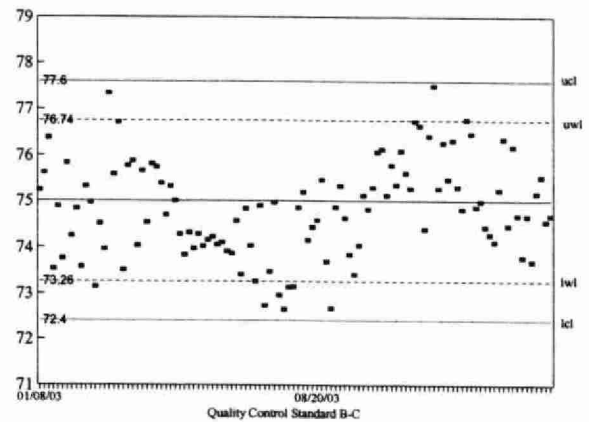
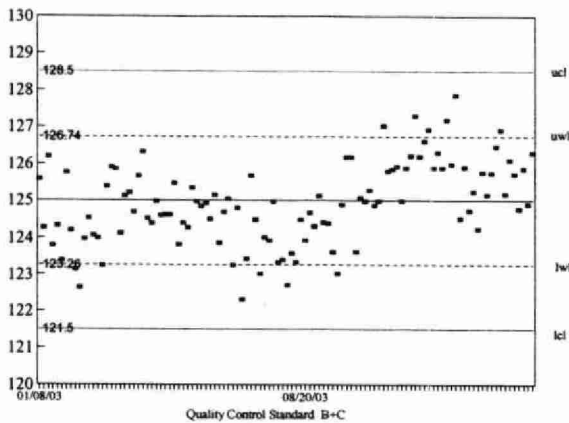
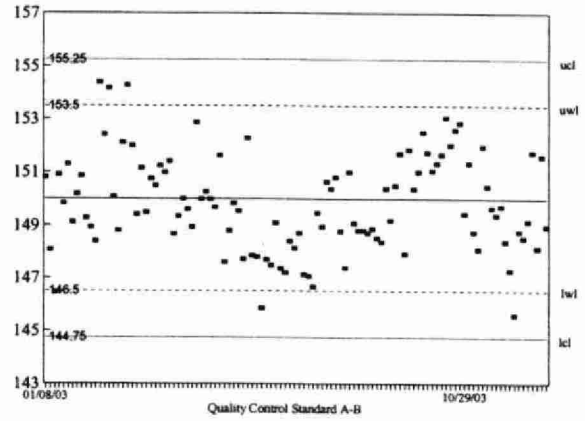
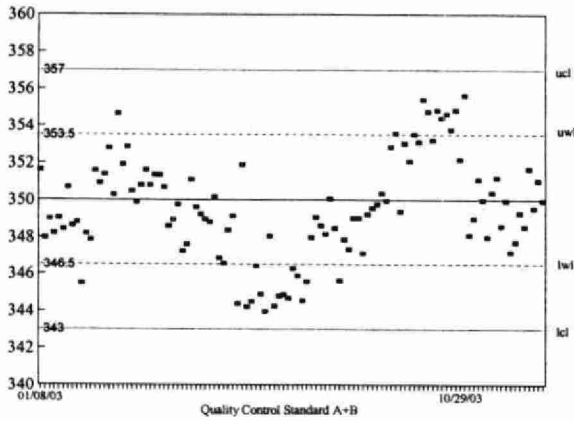
DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
41	0 - 50	0.4992	2.0
87	51 - 100	0.7025	0.9
168	101 - 300	0.8520	0.4
18	301 - 1000	1.1612	0.3
314	Overall	0.7968	

ALKALINITY, TOTAL FIXED ENDPOINT (E3218)

QUALITY CONTROL DATA FROM 01/08/03 TO 12/29/03

Analytical Range: to 1000 mg/L as CaCO_3



BROMATE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	10/09/2002
Method Reference No.	E3434	Reporting Unit	µg/L as BrO ₃ ⁻
LIMS Product Code	BROM3434	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required	50 mL
Container	PET bottle

ANALYTICAL PROCEDURE:

Via ion chromatography (IC), bromate and bromide are separated from other anions using columns packed with ion exchange resin and an eluent solution of sodium carbonate. The ions of interest are detected by an electrochemical detector and an Ultraviolet/visible (UV/VIS) absorbance detector. The concentration of Bromide and Bromate in µg/L as BrO₃⁻ & Br⁻ is determined by comparison of the sample scan to a series of standard scans.

INSTRUMENTATION:

Basic automated modular continuous flow ion chromatographic system with gradient flow control module, a postcolumn delivery system (pneumatically controlled), a heated postcolumn reaction coil and an Ultraviolet/visible (UV/VIS) absorbance detector.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.2	Current T value: 1.0
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CALIBRATION:

BL plus 6 standards

CONTROLS:

Calibration	LTBL plus 2 standards, e.g., QCA
Drift	In run standards every 10 samples
Recovery	BL and samples spiked with 5 µg/L Bromate solution

BROMATE (E3434)

QUALITY CONTROL DATA FROM 09/22/02 TO 11/04/03

Analytical Range: to 15.00 µg/L as BrO₃**CALIBRATION CONTROL:**

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	12	12	12.1021	0.1021	0.2442
B:	12	3	2.9166	-0.0834	0.1820
A+B:		15	15.0186	0.0186	0.3998
A-B:		9	9.1855	0.1855	0.1601

s.d.(AB) S(between runs): 0.2153 Sw(within run): 0.1132 S/Sw: 1.90

The calibration is accepted if the calibration control values obtained lie within the ranges:

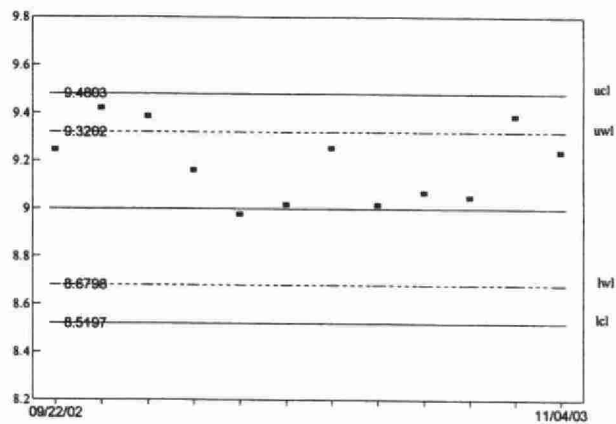
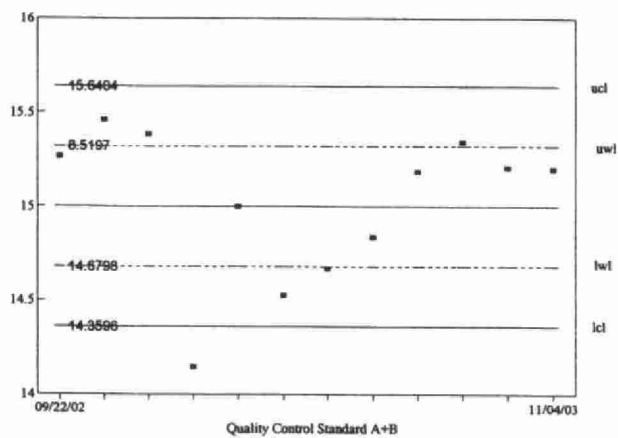
14.3596	-	15.6404	for	A+B
8.5197	-	9.4803	for	A-B

OTHER CHECKS: (October 8, 2002)

	n	Mean	Standard Deviation (1)
Spike Recovery (5 µg/L)	80	4.655	0.1481
Long Term Blank	20	0.042	0.046

BROMATE (E3434)

QUALITY CONTROL DATA FROM 09/22/02 TO 11/04/03

Analytical Range: to 15.00 µg/L as BrO₃

BROMIDE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	10/09/2002
Method Reference No.	E3434	Reporting Unit	µg/L as Br ⁻
LIMS Product Code	BROM3434	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required	50 mL
Container	PET bottle

ANALYTICAL PROCEDURE:

Via ion chromatography (IC), bromate and bromide are separated from other anions using columns packed with ion exchange resin and an eluent solution of sodium carbonate. The ions of interest are detected by an electrochemical detector and an Ultraviolet/visible (UV/VIS) absorbance detector. The concentration of Bromide and Bromate in µg/L as BrO₃⁻ & Br⁻ is determined by comparison of the sample scan to a series of standard scans.

INSTRUMENTATION:

Basic automated modular continuous flow ion chromatographic system with gradient flow control module, a postcolumn delivery system (pneumatically controlled), a heated postcolumn reaction coil and an Ultraviolet/visible (UV/VIS) absorbance detector.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.2	Current T value: 1.0
--------------------------------	----------------------	----------------------

CALIBRATION:

BL plus 6 standards

CONTROLS:

Calibration	LTBL plus 2 standards, e.g., QCA
Drift	In run standards every 10 samples

BROMIDE (E3434)

QUALITY CONTROL DATA FROM 09/22/02 TO 11/04/03

Analytical Range: to 30.00 µg/L as Br⁻**CALIBRATION CONTROL:**

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	12	24	24.0747	0.0747	0.3423
B:	12	6	6.0811	0.0811	0.5270
A+B:		30	30.1557	0.1557	0.5756
A-B:		18	17.9936	-0.0064	0.6771

s.d.(AB) S(between runs): 0.4443 Sw(within run): 0.4788 S/Sw: 0.90

The calibration is accepted if the calibration control values obtained lie within the ranges:

27.2917	-	32.7083	for	A+B
15.9687	-	20.0313	for	A-B

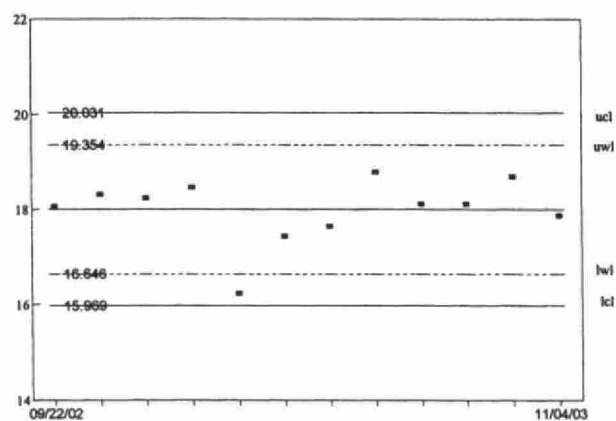
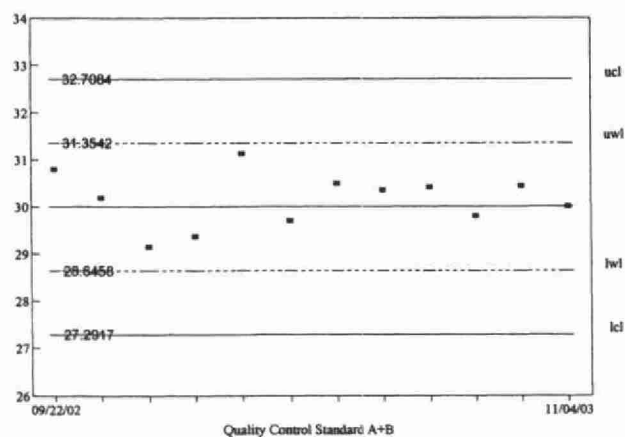
OTHER CHECKS: (October 8, 2002)

	n	Mean	Standard Deviation (1)
Long Term Blank	20	0.006	0.012

BROMIDE (E3434)

QUALITY CONTROL DATA FROM 09/22/02 TO 11/04/03

Analytical Range: to 30.00 µg/L as Br⁻



CARBON, DISSOLVED INORGANIC

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3370	Reporting Unit	mg/L as C
LIMS Product Code	DCSI3370	Supervisor	P.Wilson
Sample Type/Matrix	Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water Ground Water, Leachates, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Dissolved inorganic carbon, which is determined colourimetrically on the supernatant of a settled sample, is converted to carbon dioxide gas by acidification. The gas then passes through a gas-permeable membrane into a weakly-buffered alkaline phenolphthalein solution. The decrease in absorbance of this coloured solution is a measure of the dissolved inorganic carbon content of the sample.

Approximate absorbance: 0.3 at the full scale level.

Dissolved organic carbon, and reactive silicates are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus the following modules: air (CO₂-free) supply, dialysis unit. Colourimetric measurement is through a 5.0 cm. light path at 550 nm. Data capture and processing via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.2	Current T value: 1.0
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g., QCA
Drift	BL , standard and BL every 10 samples

NOTES:

December 1998: The HP data capture/processing system was replaced by Labtronics.

Carbon; dissolved inorganic (E3370)

Analytical Range : to 80 mg/L as C

CALIBRATION CONTROL:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	58	64	64.1207	0.1207	0.3099
B	58	16	16.0397	0.0397	0.3217
C	58	4	4.1517	0.1517	0.176
A + B		80	80.1603	0.1603	0.4341
A - B		48	48.081	0.081	0.459
B + C		20	20.1914	0.1914	0.4309
B - C		12	11.8879	-0.1121	0.2884

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.3159
	Within Runs	0.3246
	Between/Within	0.9732

s.d.(BC)	Between Runs	0.2593
	Within Runs	0.2039
	Between/Within	1.2717

Control Limits

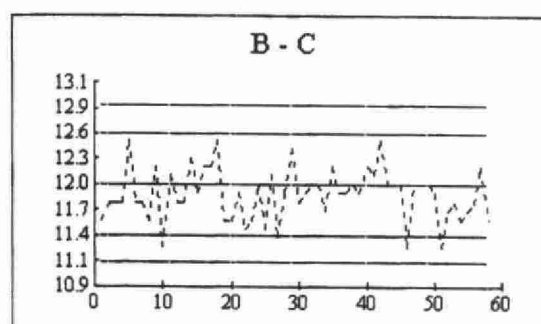
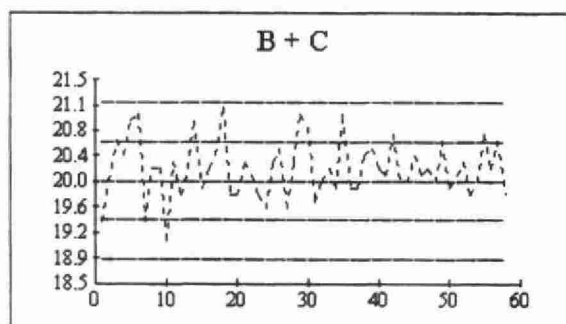
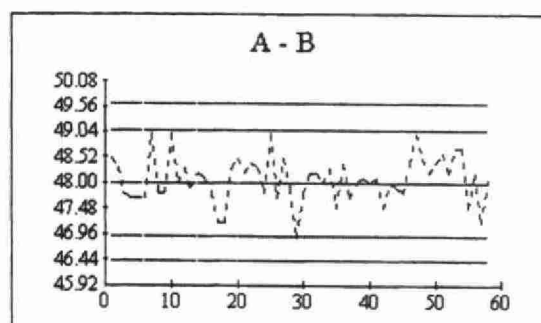
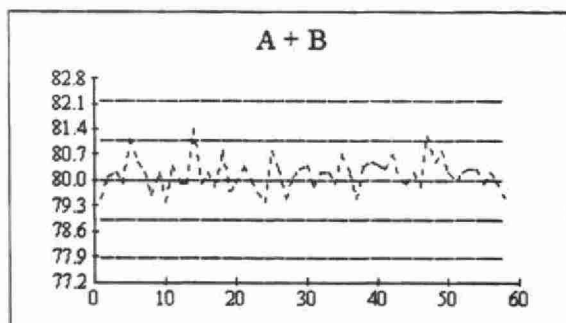
Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	81.07	78.93	82.14	77.86
A - B	49.07	46.93	49.6	46.4
B + C	20.58	19.42	21.1	18.8
B - C	12.58	11.42	12.88	11.12

Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
15	0 - 10%	0.184	5
27	10 - 20%	0.256	2.3
96	20 - 50%	0.24	1
29	50 - 100%	0.373	0.7
167	Total	0.266	1.1

Other Checks	Number	Mean	Std. Dev.
LTB	58	0.1586	0.2248

QC Data: 1/1/03 to 12/31/03



CARBON, DISSOLVED ORGANIC

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3370	Reporting Unit	mg/L as C
LIMS Product Code	DCSI3370	Supervisor	P.Wilson
Sample Type/Matrix	Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water Ground Water, Leachates, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Using an automated system, the supernatant from a settled sample is acidified and flushed with nitrogen gas to remove inorganic carbon. Organic carbon is then oxidized to carbon dioxide gas by exposure to ultra-violet light (UV) in acid-persulphate media. The gas then passes through a gas-permeable membrane into a weakly-buffered alkaline phenolphthalein solution. The decrease in absorbance of this coloured solution is a measure of the dissolved organic carbon content of the sample. Approximate absorbance: 0.3 at the full scale level.

Dissolved inorganic carbon, and reactive silicates are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus the following modules: nitrogen and air (CO₂-free) supplies with flow controls, dialysis unit, UV digester. Colourimetric measurement is through a 5.0 cm. light path at 550 nm. Data capture and processing via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.1	Current T value: 0.5
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g., QCA
Drift	BL , standard and BL every 10 samples

NOTES:

December 1998: The HP data capture/processing system was replaced by Labtronics.

Carbon; dissolved organic (E3370)

Analytical Range : to 20 mg/L as C

CALIBRATION CONTROL:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	58	16	15.966	0.034	0.1003
B	58	4	4.0216	0.0216	0.1117
C	58	1	0.9764	0.0236	0.1058
A + B		20	19.9876	0.0124	0.1548
A - B		12	11.9445	0.0555	0.1453
B + C		5	4.9979	0.0021	0.2
B - C		3	3.0452	0.0452	0.0858

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.1061
	Within Runs	0.1027
	Between/Within	1.0331

s.d.(BC)	Between Runs	0.1088
	Within Runs	0.0607
	Between/Within	1.7924

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	20.28	19.72	20.56	19.44
A - B	12.28	11.72	12.42	11.58
B + C	5.22	4.78	5.44	4.56
B - C	3.22	2.78	3.33	2.67

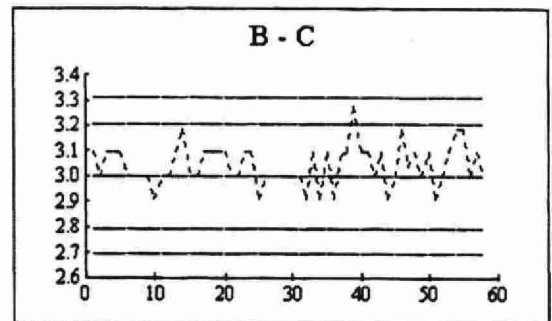
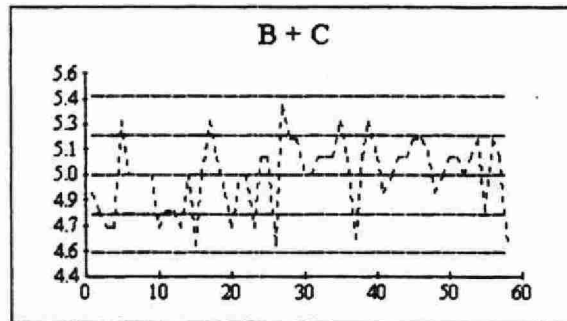
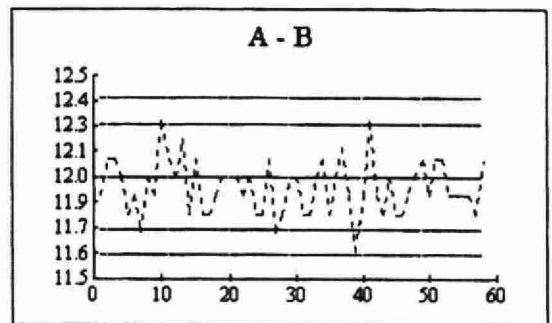
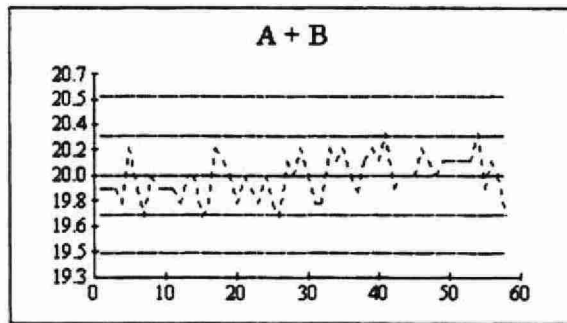
Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
73	0 - 10%	0.17	11.8
38	10 - 20%	0.121	4.1
50	20 - 50%	0.145	2.4
5	50 - 100%	0.214	1.8
166	Total	0.154	4.4

Other Checks	Number	Mean	Std. Dev.
LTB	58	-0.0086	0.1144

Carbon, dissolved organic (E3370A)

QC Data: 1/1/03 to 12/31/03



CHLORIDE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3004	Reporting Unit	$\mu\text{g}/\text{m}^3$ as Cl
LIMS Product Code	ANION3004	Supervisor	P. Wilson
Sample Type/Matrix	Air; HiVol Glass Fibre, Quartz and Polyflon, Other Filters and Puff		

SAMPLING:

Quantity Required	3/4" or 1.9cm strip from 8"x10" filter
Container	50 mL polypropylene tube

SAMPLING PREPARATION:

A 3/4" filter strip is cut in pieces and deposited into a 50 mL polypropylene tube. 50 mL of Pure-Water is added to the tube. The tube is placed on a horizontal shaker for approximately 1 hour. The supernatant is then filtered into a 15 mL plastic tube and analysed.

ANALYTICAL PROCEDURE:

Chloride is separated from other anions in the sample by automated suppressed ion chromatography using an eluent mixture of sodium bicarbonate and sodium carbonate and a conductivity detector. The concentration of chloride (mg/L) is determined by the comparison of the analyte peak area count to that of a series of standards. The analyte result is corrected for the filter blank before the final calculation. The result is reported as $\mu\text{g}/\text{m}^3$ as Cl. Nitrate and sulphate are determined simultaneously.

INSTRUMENTATION:

Horizontal Shaker, ion chromatographic system plus a PC with ChromPerfect software and DT2804 card for automated sample injection, timing, and data processing.

REPORTING:

Maximum Significant Figures: 3	Current W value: $0.1 \mu\text{g}/\text{m}^3$	Current T value: $0.5 \mu\text{g}/\text{m}^3$
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CALIBRATION:

6 standards

CONTROLS:

Calibration	MB, IS(n), CS1, and CS2, QCA and QCB
Drift	Duplicate plus 2 standards approximately every 20 samples
Recovery	CS3, CS4 & CS5

Note: IS(n) calibration controls were discontinued on August 15, 2003.

CS3 recovery control was discontinued on February, 2003.

QCA & QCB are put on line since June, 2003.

CHLORIDE cont'd

NOTES:

To convert unit from mg/L to $\mu\text{g}/\text{m}^3$, the final concentration of Cl in mg/L is multiplied by the following formula:

$$\text{Result (mg/L)} \times 50\text{mL} \times (63/6.75) / \text{air volume} = \mu\text{g}/\text{m}^3$$

Where: 63 is the area of the filter exposed and 6.75 is the sample aliquot area in square inch.

CHLORIDE (E3004)**QUALITY CONTROL DATA FOR 2003**

Analytical Range: to 100 mg/L

CALIBRATION CONTROL:

Quality Control data for 06/25/03 to 12/11/03:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	25	80	79.52	-0.48	0.5036
B:	25	20	20.20	0.20	0.2345
A+B:		100	99.72	-0.28	0.4084
A-B:		60	59.33	-0.67	0.6711

s.d.(AB) S(between runs): 0.39

Sw(within run): 0.47

S/Sw: 0.83

The calibration is accepted if the calibration control values obtained lie within the ranges:

96.98 - 102.46 for A+B

57.27 - 61.38 for A-B

Certified Reference standard data for 01/03/03 to 08/06/03:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
IS1	41	6.81	6.81	0.00	0.1025
IS2	41	7.77	7.82	0.05	0.0819
IS3	41	30.16	30.54	0.38	0.2078
IS4	41	89.45	90.45	1.00	0.5840

The standards are accepted if the control values obtained lie within the ranges:

6.41 - 7.21 for IS1

7.38 - 8.16 for IS2

29.34 - 30.98 for IS3

87.66 - 91.24 for IS4

In House Control standard data for 01/08/03 to 11/27/03:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
CS4	36	3.09	3.01	-0.08	0.1289
CS5	36	19.19	19.14	-0.05	0.3349

The standards are accepted if the control values obtained lie within the ranges:

2.41 - 3.77 for CS4
18.13 - 20.14 for CS5

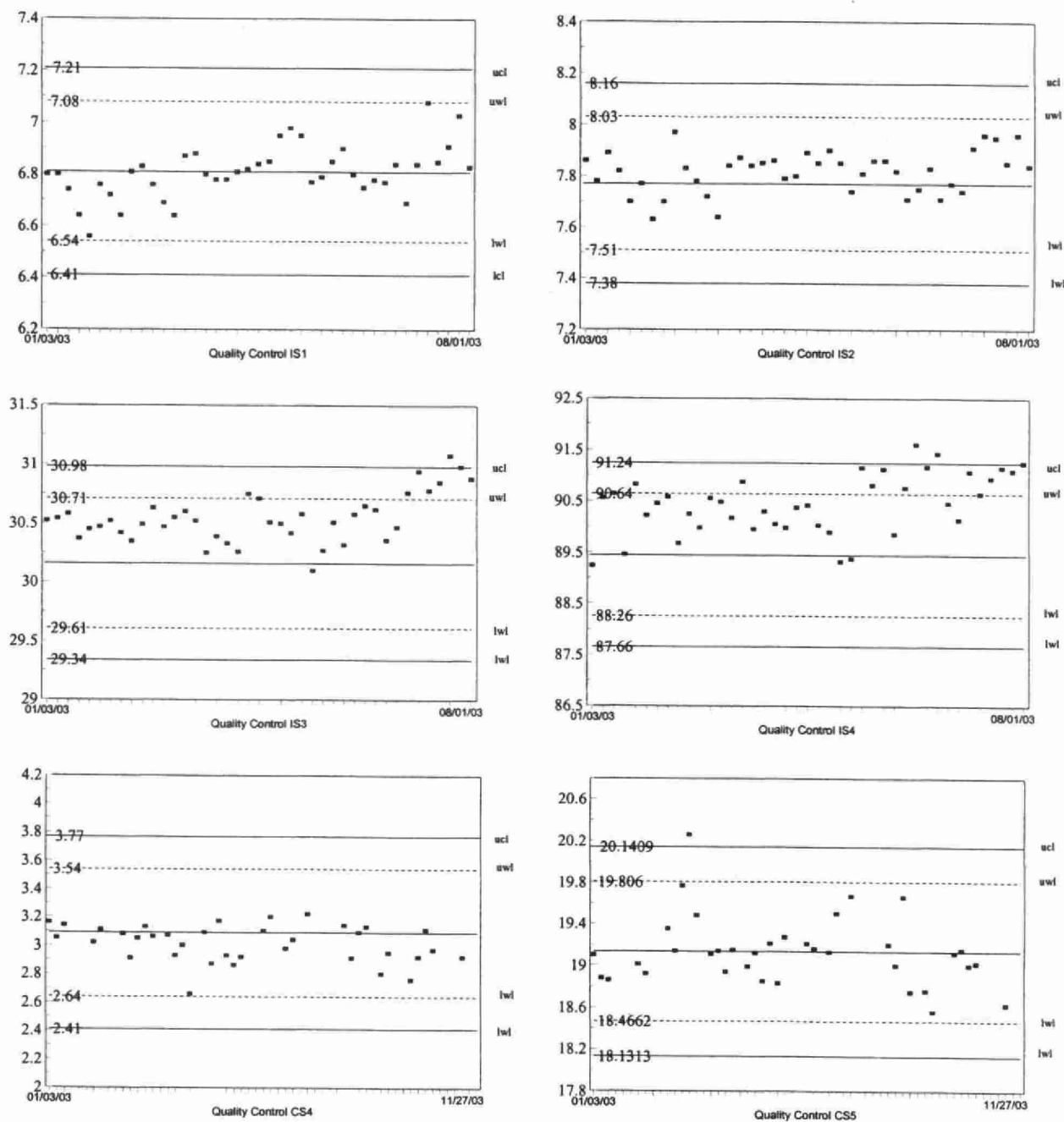
DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
91	0.0 - 2.86	0.0432	10.5
5	2.89 - 7.15	0.0837	1.39
0	7.18 - 14.31	N.A.	N.A.
0	14.33 - 28.61	N.A.	N.A.
96	Overall	0.0462	

CHLORIDE (E3004)

QUALITY CONTROL DATA FOR 2003

Analytical Range For IS Controls: to 100 mg/L
Analytical Range For CS Controls: to 28.61 $\mu\text{g}/\text{m}^3$

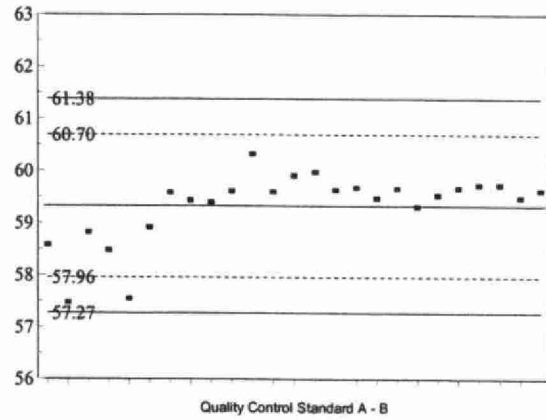
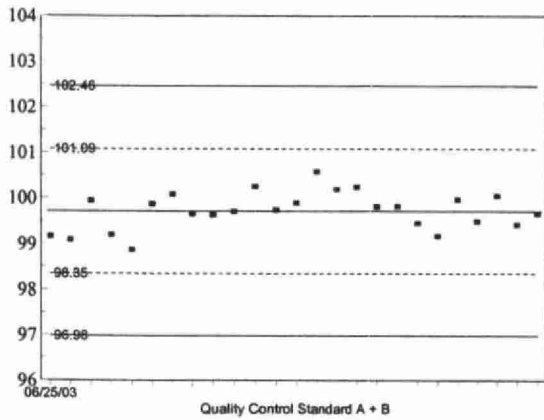


Note: For explanation of any exceedence, refer to raw data file.

CHLORIDE (E3004)

QUALITY CONTROL DATA FROM 06/25/03 TO 12/11/03

Analytical Range: to 100 mg/L



CHLORIDE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/01/86
Method Reference No.	E3013	Reporting Unit	µg/g as Cl
LIMS Product Code	ANION3013, CL3013	Supervisor	P. Wilson
Sample Type/Matrix	Soil and Sediment		

SAMPLING:

Quantity Required	20 g
Container	glass or plastic

SAMPLING PREPARATION:

A 3.0 g sample air dried, sieved soil or air dried sieved and ground sediment is placed in a 50 mL centrifuge tube and shaken with 30 mL Pure-DW for 1 hour on a shaker. Samples are centrifuged, membrane filtered and analyzed for chloride and sulphate by ion chromatography.

ANALYTICAL PROCEDURE:

Chloride is separated from other anions in the sample by automated suppressed ion chromatography using an eluent mixture of sodium bicarbonate and sodium carbonate and a conductivity detector. The concentration of chloride (mg/L) is determined by the comparison of the analyte peak area count to that of a series of standards. The result is reported as µg/g as Cl.

Sulphate is determined simultaneously.

INSTRUMENTATION:

Horizontal Shaker, ion chromatographic system plus a PC with ChromPerfect software and DT2804 card for automated sample injection, timing, and data processing.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.5 µg/g	Current T value: 2.5 µg/g
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CALIBRATION:

8 standards

CONTROLS:

Calibration	MB, IS(n), CS1, CS2, QCA and QCB
Drift	Duplicate plus 2 standards approximately every 20 samples

Note: IS(n) calibration controls were discontinued on August 15, 2003.
QCA & QCB are put on line since June, 2003.

CHLORIDE (E3013)**QUALITY CONTROL DATA FOR 2003**

Analytical Range: to 100 mg/L

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	25	80	79.52	-0.48	0.5036
B:	25	20	20.20	0.20	0.2345
A+B:		100	99.72	-0.28	0.4084
A-B:		60	59.33	-0.67	0.6711

s.d.(AB)

S(between runs): 0.39

Sw(within run): 0.47

S/Sw: 0.83

The calibration is accepted if the calibration control values obtained lie within the ranges:

96.98 - 102.46 for A+B
 57.27 - 61.38 for A-B

Certified Reference standard data for 01/03/03 to 08/06/03:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
IS1	41	6.81	6.81	0.00	0.1025
IS2	41	7.77	7.82	0.05	0.0819
IS3	41	30.16	30.54	0.38	0.2078
IS4	41	89.45	90.45	1.00	0.5840

The standards are accepted if the control values obtained lie within the ranges:

6.41 - 7.21 for IS1
 7.38 - 8.16 for IS2
 29.34 - 30.98 for IS3
 87.66 - 91.24 for IS4

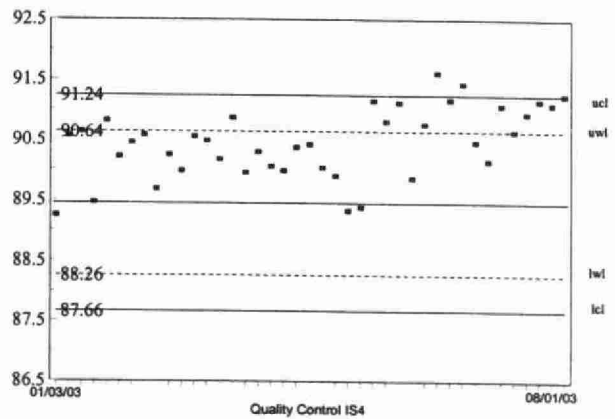
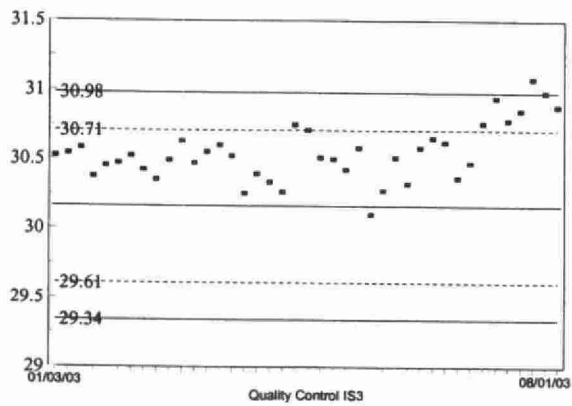
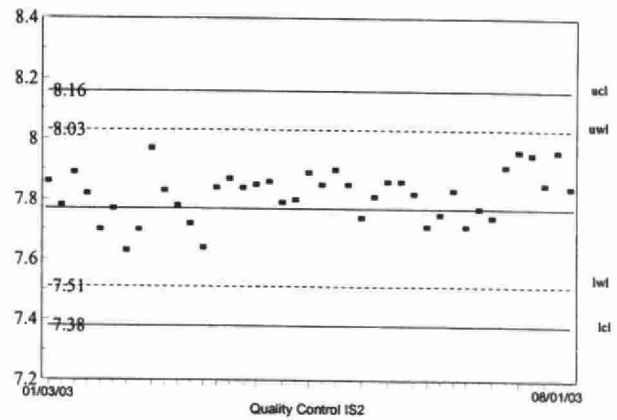
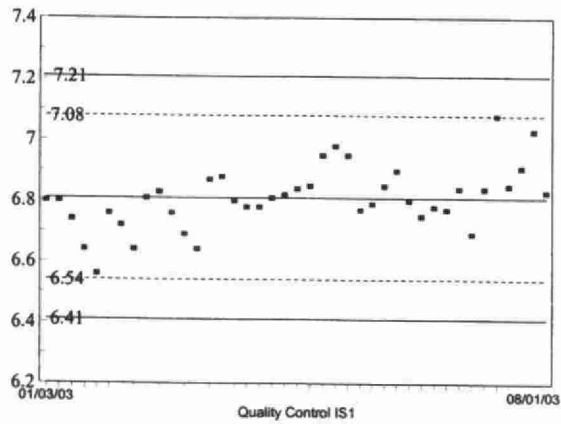
DUPLICATES:

n Data Pairs	Sample Concentration Span (µg/g)	Standard Deviation (2)	Coefficient of variation(%)
8	0.0 - 200	0.6810	0.9
13	201 - 500	2.6013	0.6
11	500 - 1000	4.0790	0.6
32	Overall	2.9299	

CHLORIDE (E3013)

QUALITY CONTROL DATA FROM 01/03/03 TO 08/16/03

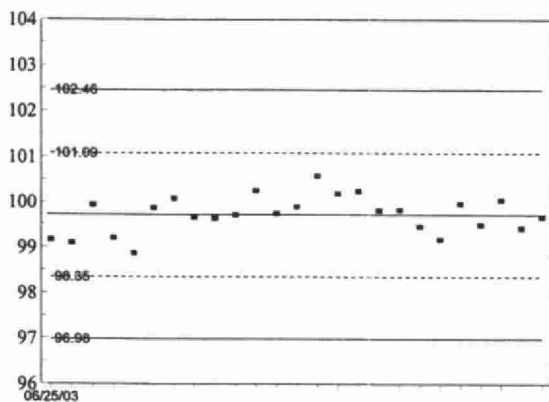
Analytical Range For IS Controls: to 100 mg/L



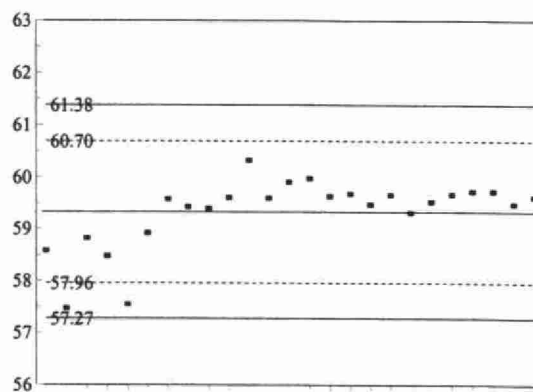
CHLORIDE (E3013)

QUALITY CONTROL DATA FROM 06/25/03 TO 12/11/03

Analytical Range: to 100 mg/L



Quality Control Standard A + B



Quality Control Standard A - B

CHLORIDE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/05/75
Method Reference No.	E3016	Reporting Unit	mg/L as Cl
LIMS Product Code	CL3016	Supervisor	P. Wilson
Sample Type/Matrix	Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water, Ground Water, Leachate, Surface Water		

SAMPLING:

Quantity Required:	10 mL
Container:	Plastic

ANALYTICAL PROCEDURE:

Chloride ions are combined with mercuric thiocyanate releasing thiocyanate quantitatively. Thiocyanate then reacts with ferric ions to produce ferric thiocyanate (red), and the absorbance of the latter is measured colourimetrically.

Approximate absorbance: 0.5 at the full scale level.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 1.5 cm light path at 480 nm.

Data capture and processing via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.2	Current T value: 1.0
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CALIBRATION:

BL plus 12 standards

CONTROLS:

Calibration:	LTBL plus 3 standards, e.g. QCA
Drift:	BL and standard after every 12 samples

NOTES:

April 1998: The HP data capture/processing system was replaced by Labtronics. Two additional Calibration standards were added at the low end of the curve.

Chloride (E3016)

Analytical Range : to 100 mg/L as Cl

CALIBRATION CONTROL:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	91	75	75.2912	0.2912	0.2874
B	91	25	25.0792	0.0792	0.1941
C	91	5	5.008	0.008	0.1006
A + B		100	100.3704	0.3704	0.3743
A - B		50	50.212	0.212	0.3169
B + C		30	30.0873	0.0873	0.2236
B - C		20	20.0712	0.0712	0.2137

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.2452
	Within Runs	0.2241
	Between/Within	1.0942

s.d.(BC)	Between Runs	0.1546
	Within Runs	0.1511
	Between/Within	1.0232

Control Limits

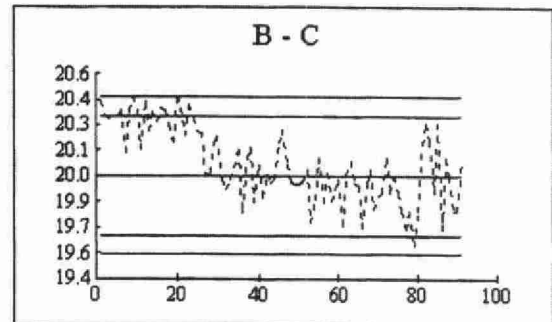
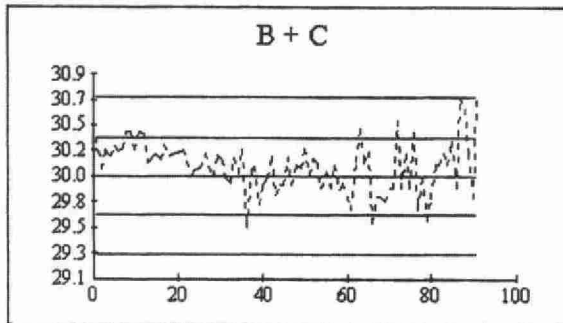
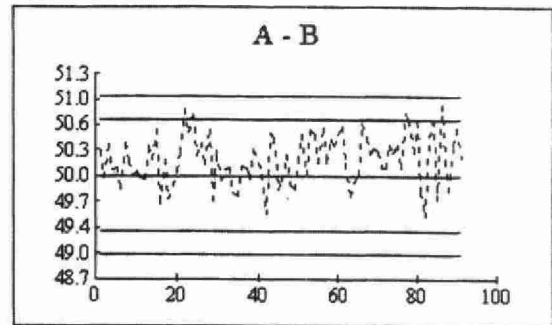
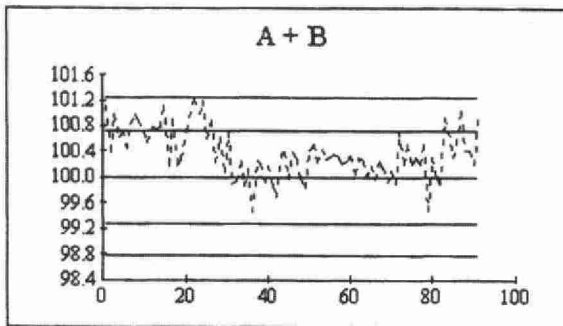
Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	100.7	99.3	101.3	98.7
A - B	50.7	49.3	51	49
B + C	30.34	29.66	30.7	29.3
B - C	20.34	19.66	20.5	19.5

Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
58	0 - 10%	0.134	2.7
56	10 - 20%	0.11	0.7
83	20 - 50%	0.254	0.9
32	50 - 100%	0.383	0.6
229	Total	0.227	0.9

Other Checks	Number	Mean	Std. Dev.
LTB	91	0.0607	0.1259

QC Data: 1/1/03 to 12/31/03



CHLOROPHYLL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/75
Method Reference No	E3169	Reporting Unit	µg/L
LIMS Product Code	CHL3169	Supervisor	P. Wilson
Sample Type/Matrix	Effluent, Drinking Water, Surface Water		

SAMPLING:

Quantity Required	1000 mL for clear samples; 500 mL if visibly green
Container	Glass or plastic
Other	In the field a sample is filtered through a nylon filter. The filter is folded and then placed between two membrane filter-support pads, and the package is enclosed in a plastic dish labelled with the sample number and sample volume filtered, the dish is kept in the dark or wrapped in aluminum foil, and shipped immediately, or kept frozen.

ANALYTICAL PROCEDURE:

Chlorophyll 'a', chlorophyll 'b', and corrected chlorophyll 'a' (for pheophytin 'a') are determined by the extraction of the pheopigments into an acetone-water solvent followed by two computer controlled spectrophotometric scans with measurements at 630, 645 and 663 (665 for acidified) nm absorbance measurements. Also, the minimum absorbance between 710 and 750 is measured to allow for a correction due to turbidity. SCOR-UNESCO equations are used for all chlorophyll calculations.

INSTRUMENTATION:

- Automated modular continuous flow scanning spectrophotometer system
- Computer system for control of sampling, timing and data processing (i.e. data capture, calculations and transfer of results to LIMS)

REPORTING:

Chlorophyll a; corrected	Maximum Significant	Current W value: 1.0	Current T value: 5.0
Chlorophyll a; total	Figures: 3	Current W value: 0.2	Current T value: 1.0
Chlorophyll b; total		Current W value: 0.1	Current T value: 0.5

CONTROLS:

Calibration	LTBL plus 2 "standards", e.g.QCA
Drift	"standard", BL every 20 samples

NOTES:

"Standards" are prepared from chlorophyll "a" and "b", but the materials are neither analytical grade nor are their solutions stable. Thus calibration controls are based on measured averages.

NOTES (cont):

Jan 1999, the microcomputer system was replaced with a 486 PC The software written in PET BASIC was replaced by software written in CLIPPER.

May 2000 the Bechman DU7 spectrophotometer was replaced with a Bechman DU600 instrument.

CHLOROPHYLL "a" (E3169)

QUALITY CONTROL DATA FROM 01/10/03 TO 12/18/03

Reporting Unit: µg/L

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	47	3.0	3.01	0.01	0.0994
B:	47	1.0	1.09	0.09	0.0563
A+B:		4.0	4.10	0.10	0.1413
A-B:		2.0	1.92	-0.08	0.0784

s.d.(AB) S(between runs): 0.08 Sw(within run): 0.06 S/Sw: 1.5

The calibration is accepted if the calibration control values obtained lie within the ranges:

3.6 - 4.4 for A+B
1.7 - 2.3 for A-B

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
12	0 - 5.0	0.3288	15.4
5	5.1 - 10.0	0.7398	10.9
3	10.1 - 25.0	0.8651	6.1
20	Overall	0.5603	

Note: This table represents duplicate data for years 2001 & 2003. No duplicate data for year 2002.

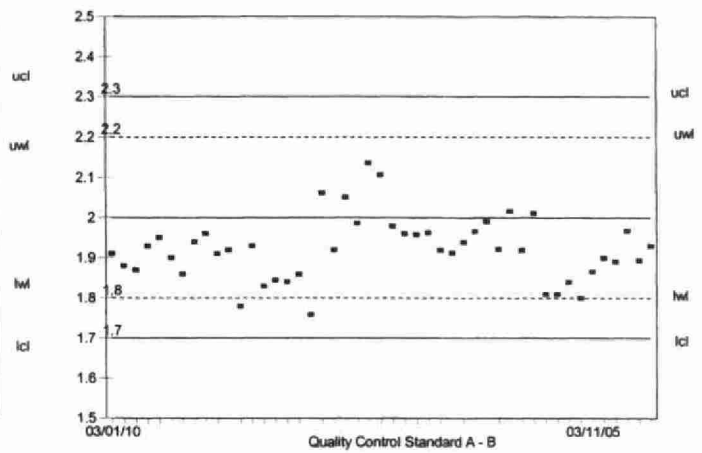
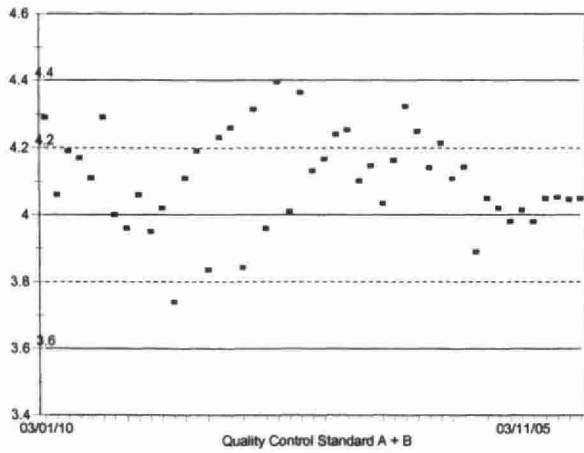
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	47	0.0075	0.0212
Filtered Blank	47	0.0103	0.0195

CHLOROPHYLL "a" (E3169)

QUALITY CONTROL DATA FROM 01/10/03 TO 12/18/03

Reporting Unit: $\mu\text{g/L}$



CHLOROPHYLL "a", ACIDIFIED (E3169)

QUALITY CONTROL DATA FROM 01/10/03 TO 12/03/03

Reporting Unit: µg/L

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	47	2.4	2.40	0.00	0.1235
B:	47	0.8	0.70	-0.10	0.0984
A+B:		3.2	3.11	-0.09	0.1898
A-B:		1.6	1.70	0.10	0.1177

s.d.(AB) S(between runs): 0.11 Sw(within run): 0.08 S/Sw: 1.34

The calibration is accepted if the calibration control values obtained lie within the ranges:

2.4 - 4.0 for A+B
1.0 - 2.2 for A-B

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
6	-0.5 - 1.0	0.2070	30.8
2	1.1 - 2.0	0.2877	20.6
3	2.1 - 5.0	0.3856	8.7
5	5.1 - 10.0	0.5908	7.2
1	10.1 - 100	N.A.	N.A.
17	Overall	0.3921	

Note: This table represents duplicate data for year 2001 & 2003. No duplicate data for year 2002.

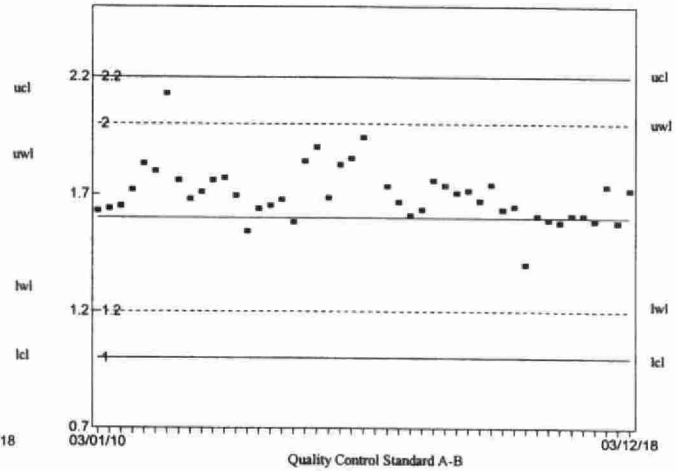
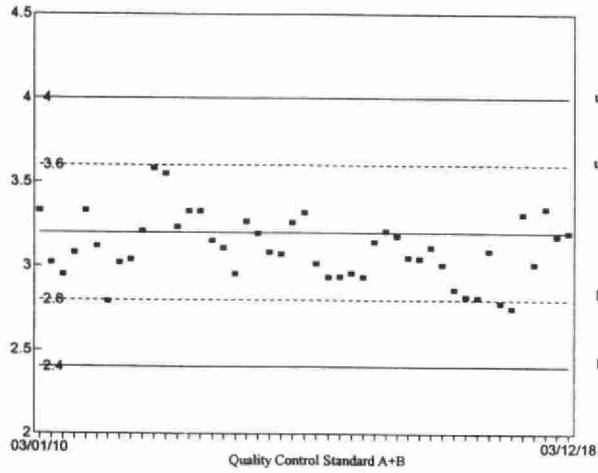
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	47	-0.2379	0.1398
Filtered Blank	47	-0.1838	0.1590

CHLOROPHYLL "a", ACIDIFIED (E3169)

QUALITY CONTROL DATA FROM 01/10/03 TO 12/18/02

Reporting Unit: $\mu\text{g/L}$



CHLOROPHYLL "b" (E3169)

QUALITY CONTROL DATA FROM 01/10/03 TO 12/18/03

Reporting Unit: µg/L

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	47	3.0	2.97	-0.03	0.1096
B:	47	1.0	1.07	0.07	0.0682
A+B:		4.0	4.04	0.04	0.1604
A-B:		2.0	1.90	-0.10	0.0870

s.d.(AB)

S(between runs):0.09

Sw(within run): 0.06

S/Sw: 1.5

The calibration is accepted if the calibration control values obtained lie within the ranges:

3.6 - 4.4 for A+B
1.7 - 2.3 for A-B

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
9	0 - 1.0	0.1691	27.8
3	1.1 - 2.0	0.1224	8.0
2	2.1 - 5.0	0.0934	3.5
14	Overall	0.1511	

Note: This table represents duplicate data from year 2001 & 2003. No duplicate data for year 2002.

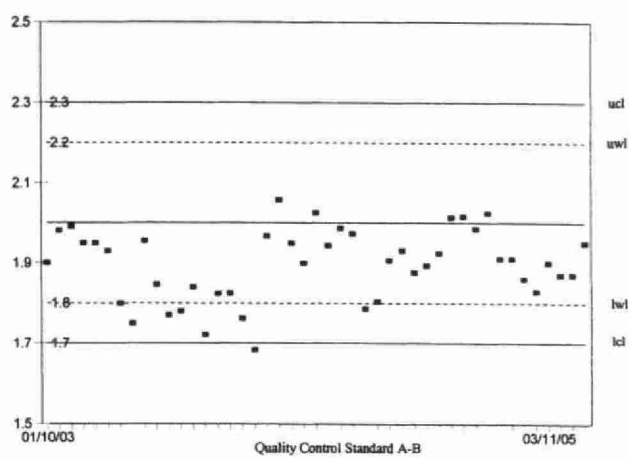
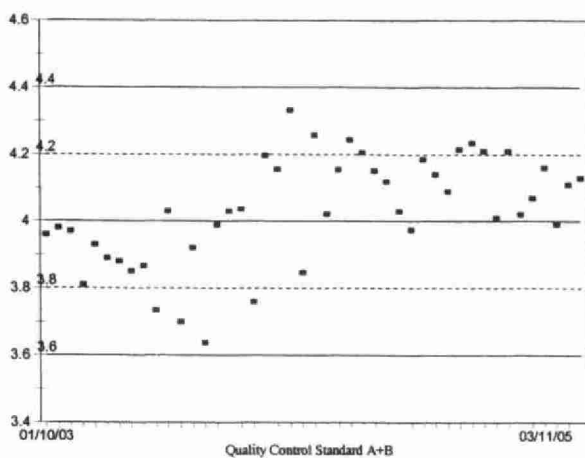
OTHER CHECKS:

	n	Mean	Standard Deviation (1)
Long Term Blank	47	0.0034	0.0348
Filtered Blank	47	0.0144	0.0645

CHLOROPHYLL "b" (E3169)

QUALITY CONTROL DATA FROM 01/10/03 TO 12/18/03

Reporting Unit: $\mu\text{g/L}$



COLOUR, TRUE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	13/03/84
Method Reference No.	E3219	Reporting Unit	TCU
LIMS Product Code	COL3219	Supervisor	P. Wilson
Sample Type/Matrix	Effluent, Industrial Waste, Drinking Water, Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

True colour is measured colourimetrically on the supernatant of a settled sample in a system calibrated with acidified chloroplatinate standards. The sample stream is measured using a broadband blue filter. Residual turbidity effects are suppressed by using a broadband red filter and increased path length in the reference stream.

Approximate absorbance: 0.3 at the full scale level.

INSTRUMENTATION:

Basic automated modular continuous flow system. Colour measurement is through a 3.0 cm. light path using a broadband filter (400-450 nm). Turbidity measurement is through a 5.0 cm. light path using a different broadband filter (660-740 nm). Data capture and processing via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.2	Current T value: 1.0
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CALIBRATION:

BL plus 6 standards

CONTROLS:

Calibration	LTBL plus 2 standards, e.g. QCA
Drift	BL and standard after every 10 samples

NOTES:

The HP data capture/processing system was replaced by Labtronics in November 1998.

Colour;true (E3219)

Analytical Range : to 100 mg/L as TCU

CALIBRATION CONTROL:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	46	70	70.8722	0.8722	0.3672
B	46	25	25.4889	0.4889	0.3705
C	46	7.5	7.0643	0.4357	0.4245
A + B		95	96.3611	1.3611	0.5593
A - B		45	45.3833	0.3833	0.4811
B + C		32.5	32.5533	0.0533	0.712
B - C		17.5	18.4246	0.9246	0.3578

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.3688
	Within Runs	0.3402
	Between/Within	1.0841

s.d.(BC)	Between Runs	0.3984
	Within Runs	0.253
	Between/Within	1.5747

Control Limits

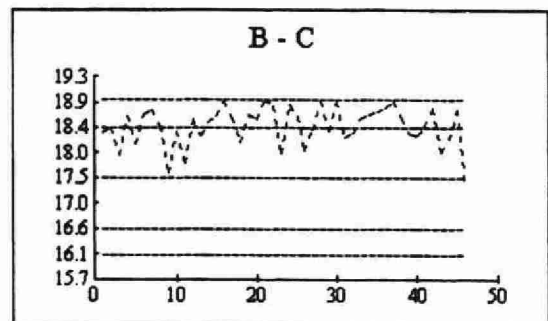
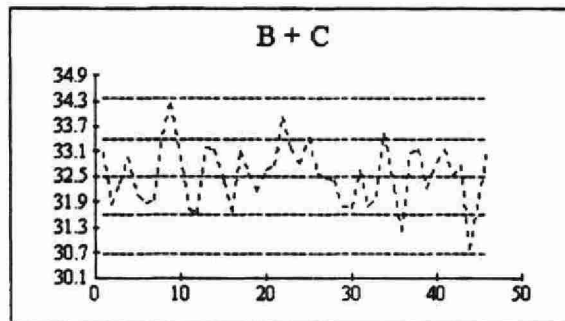
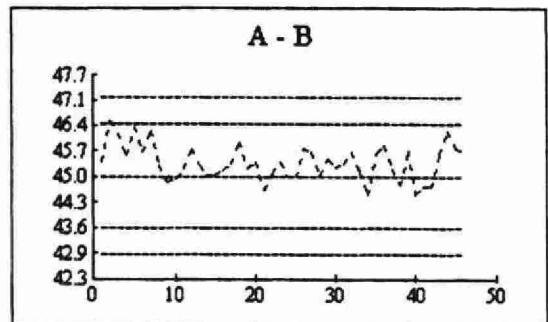
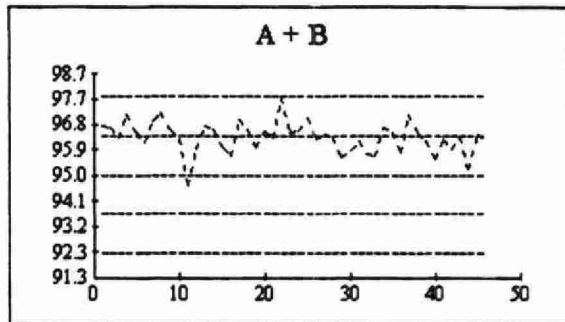
Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	96.11	93.59	97.82	92.18
A - B	46.46	43.59	47.11	42.89
B + C	33.43	31.57	34.35	30.65
B - C	18.43	16.52	18.89	16.11

Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
88	0 - 10%	0.426	22.1
14	10 - 20%	0.473	3.2
17	20 - 50%	0.861	2.4
4	50 - 100%	1.309	2.1
123	Total	0.56	5.6

Other Checks	Number	Mean	Std. Dev.
LTB	46	-0.5109	0.4771

QC Data: 1/1/03 to 12/31/03



CONDUCTIVITY

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced:	01/04/74
Method Reference No:	E3218	Reporting Units:	$\mu\text{S/cm}$ at 25°C
LIMS Product Code:	PHALCO3218,CONDPH3218	Supervisor:	P. Wilson
Sample Type/Matrix:	Sludge, Effluent, Industrial Waste, Raw Sewage, Drinking Water, Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required:	50 mL
Container:	Glass or plastic

ANALYTICAL PROCEDURE:

After equilibration at room temperature, the conductivity of the sample is measured. Temperature compensation is applied by the system. Total fixed endpoint alkalinity and pH are determined simultaneously.

INSTRUMENTATION:

Automated modular continual flow conductivity system comprising of a sampler and conductivity meter with cell plus computer control and data processing software.

REPORTING:

Maximum Significant Figures: 3	Current W value: 1	Current T value: 5
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CONTROLS:

Calibration:	LTBL plus 4 standards, e.g. QCA
Drift:	In run standards throughout the run (tap water diluted to 50% V/V)

CONDUCTIVITY (E3218)

QUALITY CONTROL DATA FROM 01/08/03 TO 12/29/03

Analytical Range: to 2000 $\mu\text{S/cm}$

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	112	1413	1411.66	-1.34	3.9629
B:	112	718	716.79	-1.21	2.1012
C:	112	147	147.25	0.25	0.6634
D:	112	37.1	37.11	0.01	0.3339
A+B:		2131	2128.45	-2.55	5.3571
A-B:		695	694.87	-0.13	3.3971
B+C:		865	864.04	-0.96	2.5475
B-C:		571	569.55	-1.45	1.7945
C+D:		184.1	184.35	0.25	0.8709
C-D:		109.9	110.14	0.24	0.5869

s.d.(AB)	S(between runs): 3.17	Sw(within run): 2.40	S/Sw: 1.3
s.d.(BC)	S(between runs): 1.56	Sw(within run): 1.27	S/Sw: 1.2
s.d.(CD)	S(between runs): 0.53	Sw(within run): 0.42	S/Sw: 1.3

On any given day the calibration is accepted if the calibration control values obtained lie within the ranges:

2109.8	-	2152.2	for	A+B
679.1	-	710.9	for	A-B
851.9	-	878.1	for	B+C
561.2	-	580.8	for	B-C
180.04	-	188.16	for	C+D
106.86	-	112.94	for	C-D

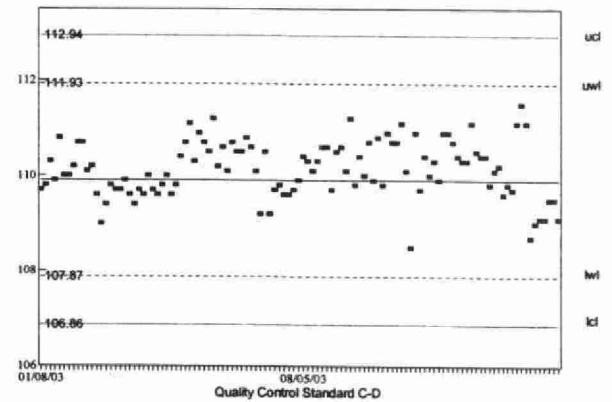
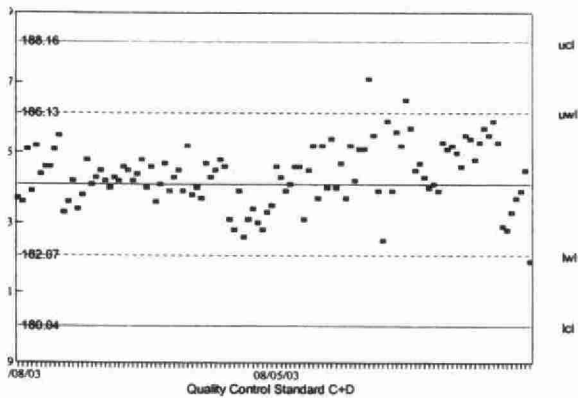
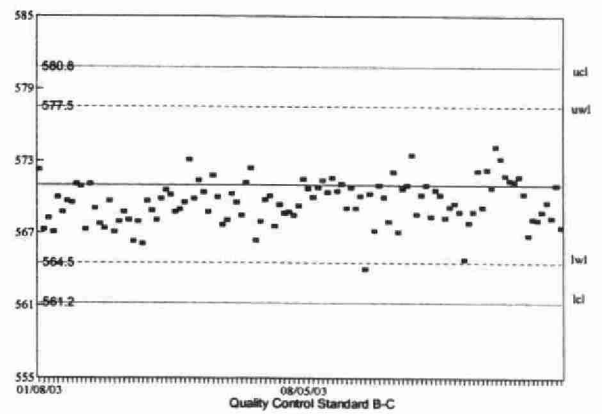
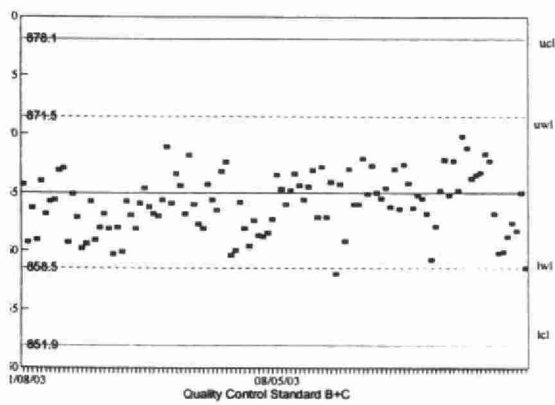
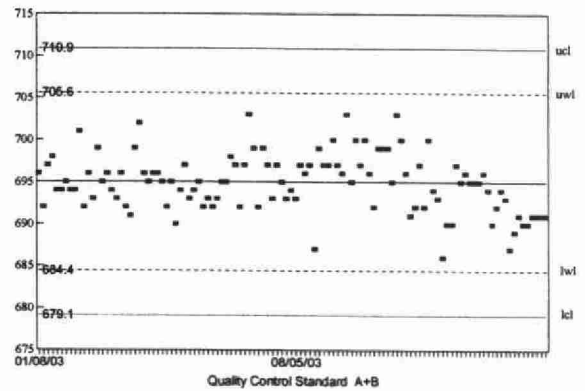
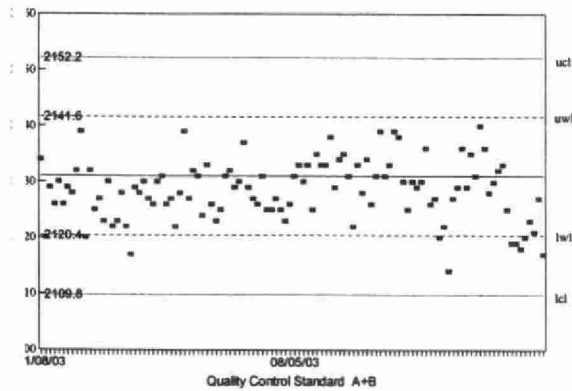
DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
68	0 - 200	0.8625	0.8
83	201 - 400	2.1071	0.7
121	401 - 1000	3.3960	0.5
27	1001 - 2000	5.0607	0.4
18	2001 - 10000	8.6603	0.2
317	Overall	3.4877	

CONDUCTIVITY (E3218)

QUALITY CONTROL DATA FROM 01/08/03 TO 12/29/03

Analytical Range: to 2000 $\mu\text{S}/\text{cm}$



CYANIDE, FREE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/01/98
Method Reference No.	E3015	Reporting Unit	Aqueous: mg/L as CN^- Solid: $\mu\text{g/g}$ as CN^-
LIMS Product Code	CNF3015	Supervisor	P. Wilson
Sample Type/Matrix	Aqueous: Surface Water, Drinking Water, Ground Water, Raw Sewage & Effluent, Industrial Effluent. Solid: Sediment, Dried Sludge, Industrial Waste		

SAMPLING:

Quantity Required:	Aqueous: 500 mL + 10 drops of 50% w/v NaOH Solid : 5 g, minimum
Container:	Glass or plastic

ANALYTICAL PROCEDURE:

Free cyanides are the simple and weakly dissociable cyanides which form HCN upon acidification to pH4.0 (such as HCN and KCN). The automated determination of free cyanide exposes the sample to distillation which isolates HCN under specific acidic conditions. A zinc sulphate solution is included which eliminates interference from complexed iron cyanides. Cyanide is determined colourimetrically by the reaction of cyanide with chloramine -T to form cyanogen chloride which further reacts with a combination of barbituric acid and isonicotinic acid to form a highly coloured coupling product, which is measured at 600 nm.

Aqueous samples are introduced directly to the continuous flow system by an autosampler. Solid samples are extracted in a sodium hydroxide solution with mechanical shaking for 6 to 8 hours and then centrifuged. The supernatant is decanted, diluted if necessary to eliminate interference from colour and introduced to the continuous flow system by the autosampler. Solid samples are not dried or ground, but weighed and extracted as received, to prevent the loss of simple cyanides. If the sample is wet, results are reported as $\mu\text{g/g}$ wet and moisture content is reported by a separate method.

INSTRUMENTATION:

Skalar automated segmented flow colourimetric system, measurement through a 500 mm light path at 600 nm.

Skalar data capture and data processing software with computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.001 mg/L 0.01 $\mu\text{g/g}$	Current T value: 0.005mg/L 0.05 $\mu\text{g/g}$
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CALIBRATION:

BL plus 6 standards (S0 to S5)

NOTE:

December 2002, vegetation matrix removed.

CONTROLS:

Calibration:	LTB plus 2 standards , e.g. QCA
Drift:	BL and check standards

CYANIDE, FREE (E3015)

QUALITY CONTROL DATA FROM 02/11/98 TO 11/19/03

Analytical Range: to 0.2 mg/L as CN

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	74	0.15	0.1506	0.0006	0.0033
B:	74	0.02	0.0189	-0.0011	0.0013
A+B:		0.17	0.1695	-0.0005	0.0033
A-B:		0.13	0.1317	0.0017	0.0037

s.d.(AB)

S(between runs): 0.0025

Sw(within run): 0.0026

S/Sw: 1.0

The calibration is accepted if the calibration control values obtained lie within the ranges:

0.154 - 0.186 for A+B
0.118 - 0.142 for A-B

REFERENCE MATERIAL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
KCN:	74	0.10	0.0946	-0.0054	0.0133
FeCN:*	74	<0.001*	0.0086	-0.0914	0.0141

* 2000 to 2003 data

FeCN is not expected to be detected for free cyanide. Results should be $\leq$ w or <0.001 although standard tested is 0.10 mg/L.

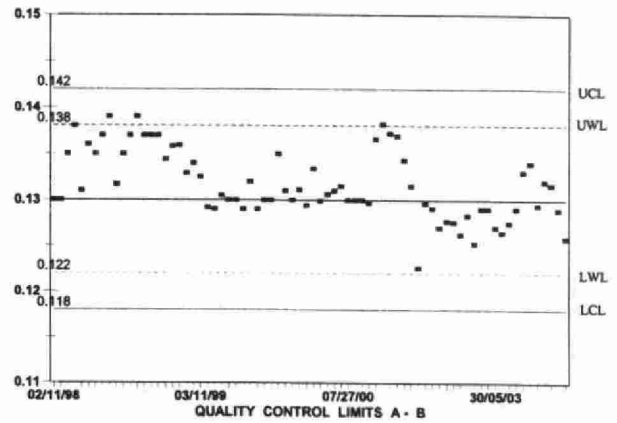
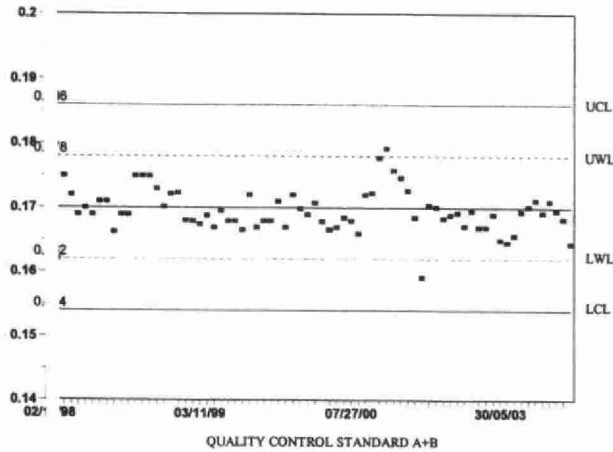
DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
144	0 - 0.020	0.0005	17.2
7	0.021 - 0.040	0.0006	2.0
15	0.041 - 0.100	0.0028	4.7
8	0.101 - 0.200	0.0026	1.8
174	Overall	0.0012	

CYANIDE, FREE (E3015)

QUALITY CONTROL DATA FROM 02/11/98 TO 11/19/03

Analytical Range: to 0.2 mg/L as CN



CYANIDE, TOTAL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/01/98
Method Reference No.	E3015	Reporting Unit	Aqueous: mg/L as CN^- Solid: $\mu\text{g/g}$ as CN^-
LIMS Product Code	CN3015, TCLPCN3015	Supervisor	P. Wilson
Sample Type/Matrix	Aqueous: Surface Water, Drinking Water, Ground Water, Raw Sewage & Effluent, Industrial Effluent. Solid: Soil, Sediment, Dried Sludge, Industrial Waste		

SAMPLING:

Quantity Required:	Aqueous: 500 mL + 10 drops of 50% w/v NaOH Solid : 5 g, minimum
Container:	Glass or plastic

ANALYTICAL PROCEDURE:

Total cyanides include free, simple (HCN , KCN) and weakly dissociable cyanides ($\text{Ni}(\text{CN})_4$) as well as those complexed cyanides that decompose to form free cyanides that distill out as HCN in an acidic environment. The automated determination of total cyanide exposes the sample to ultraviolet radiation to break down organic metallic and alkali-complexed cyanide compounds to free cyanide. The distillation step isolates HCN under specific acidic conditions. The sequential combination of UV digestion plus distillation yields the measurement of "total cyanide". Cyanide is measured colourimetrically by the reaction of cyanide with chloramine -T to form cyanogen chloride which further reacts with a combination of barbituric acid and isonicotinic acid to form a highly coloured coupling product, which is measured at 600 nm.

Aqueous samples are introduced directly to the continuous flow system from an autosampler.

Solid samples are extracted in a sodium hydroxide solution with mechanical shaking for 6 to 8 hours, then centrifuged. The supernatant is then decanted, diluted if necessary to eliminate interference from colour and introduced to the continuous flow system by the autosampler. Solid samples are not dried or ground, but weighed and extracted as received, to prevent the loss of simple cyanides. If the sample is wet, results are reported as $\mu\text{g/g}$ wet and moisture content is reported by a separate method.

INSTRUMENTATION:

Skalar automated segmented flow colourimetric system, measurement through a 500 mm light path at 600 nm. Skalar data capture and data processing software with computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.001 mg/L 0.01 $\mu\text{g/g}$	Current T value: 0.005mg/L 0.05 $\mu\text{g/g}$
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CALIBRATION:

BL plus 6 standards (S0 to S5)

CONTROLS:

Calibration:	LTB plus 2 standards , e.g. QCA
Drift:	BL and check standards

NOTE:

TCLPCN3015, LIMS product code was added on April 2001.

CYANIDE, TOTAL (E3015)

QUALITY CONTROL DATA FROM 01/14/03 TO 12/03/03

Analytical Range: to 0.2 mg/L as CN for aqueous samples

Analytical Range: to 0.2 µg/g as CN for soil samples

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	40	0.15	0.1487	-0.0013	0.0027
B:	40	0.02	0.0195	-0.0005	0.0010
A+B:		0.17	0.1681	-0.0019	0.0033
A-B:		0.13	0.1292	-0.0008	0.0024

s.d.(AB)

S(between runs): 0.0017

Sw(within run): 0.0021

S/Sw: 1.2

The calibration is accepted if the calibration control values obtained lie within the ranges:

0.154 - 0.186 for A+B
0.118 - 0.142 for A-B

REFERENCE MATERIAL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
KCN:	40	0.10	0.0931	-0.0070	0.0100
FeCN:	40	0.10	0.0878	-0.0122	0.0095
CLP Soil:(0.2)	27	44.70	48.4105	3.7105	4.0836

DUPLICATES:

Aqueous Samples:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation (%)
47	0 - 0.020	0.00019	9.3
7	0.021 - 0.040	0.0051	1.6
11	0.041 - 0.100	0.00086	1.4
49	0.101 - 0.200	0.00334	2.1
114	Overall	0.00094	

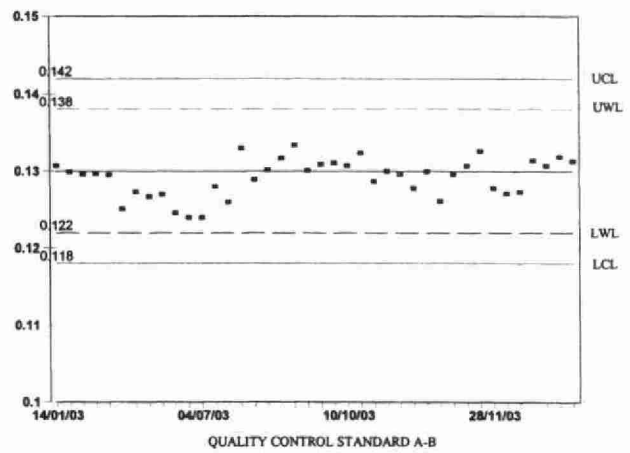
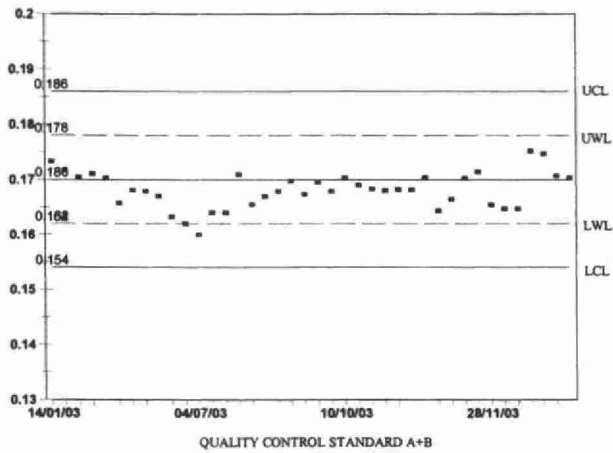
Soil Samples:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation (%)
23	0 - 0.020	0.00064	11.8
10	0.021 - 0.040	0.00046	1.7
7	0.041 - 0.100	0.00195	3.1
23	0.101 - 0.200	0.00464	2.7
63	Overall	0.00180	

CYANIDE, TOTAL (E3015)

QUALITY CONTROL DATA FROM 01/14/03 TO 12/03/03

Analytical Range: to 0.2 mg/L as CN



FLUORIDE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	October 2001
Method Reference No	E3172	Reporting Unit	mg/L as F
LIMS Product Code	F3172, ANION3172, TCLPF3172	Supervisor	P. WILSON
Sample Type/Matrix	Effluent, Industrial Waste, Process Water, Drinking Water, Ground Water, Leachate, Surface Water, Raw Sewage, Sediment, Dried Sludge, Unknown Material, Soil		

SAMPLING:

Quantity Required	50 mL
Container	Plastic

ANALYTICAL PROCEDURE:

Fluoride is separated from other anions in the samples by automated suppressed ion chromatography using an eluent mixture of 0.0010 M sodium bicarbonate and 0.0035 M sodium carbonate with conductivity detector. The concentration of fluoride in mg/L as F⁻ is determined by comparison of the sample scan to a series of standard scans.

INSTRUMENTATION:

Basic modular continuous flow ion chromatographic system, Justice Innovation ChromPerfect Spirit Data Station, plus control module (in-house design) for the automated sample introduction, timing and detector range switching.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.01	Current T value: 0.05
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CALIBRATION:

BL plus 9 standards

CONTROLS:

Calibration	LTB plus 3 standards, e.g. QCA
Drift	CHK1 and CHK2 standard approximately every 20 samples

NOTES:

This method replaced E3369, October 2001.

Method E3369 calibration control values were used to establish initial control limits for the present method.

LIMS product code TCLPF3172 was added, October 2001.

FLUORIDE (E3172)

QUALITY CONTROL DATA FROM 01/06/03 TO 12/22/03

Analytical Range: to 2.0 mg/L as F

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	100	1.60	1.58	-0.02	0.0149
B:	100	0.80	0.79	-0.01	0.0096
C:	100	0.16	0.16	0.00	0.0049
A+B:		2.40	2.37	-0.03	0.0211
A-B:		0.80	0.79	-0.01	0.0136
B+C:		0.96	0.95	-0.01	0.0118
B-C:		0.64	0.63	-0.01	0.0096

s.d.(AB) S(between runs):0.0125

Sw(within run): 0.0096

S/Sw: 1.3

s.d.(BC) S(between runs):0.0076

Sw(within run): 0.0068

S/Sw: 1.1

The calibration is accepted if the calibration control values obtained lie within the ranges:

2.35	-	2.45	for	A+B
0.762	-	0.838	for	A-B
0.914	-	1.006	for	B+C
0.606	-	0.674	for	B-C

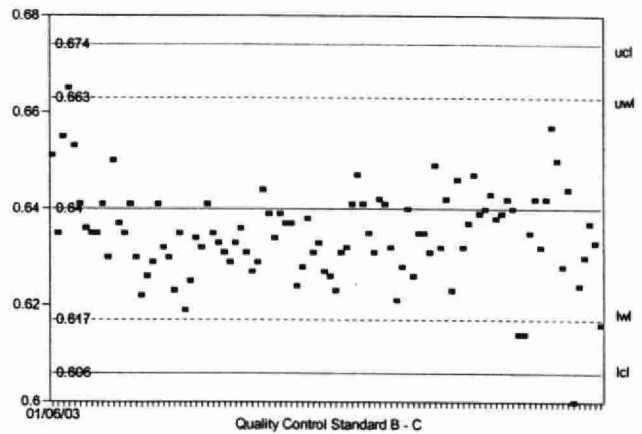
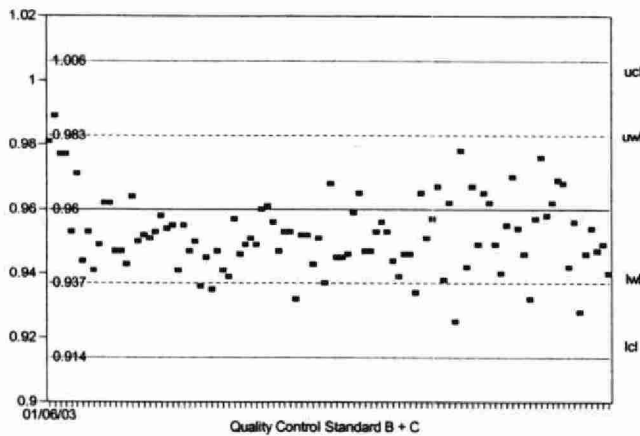
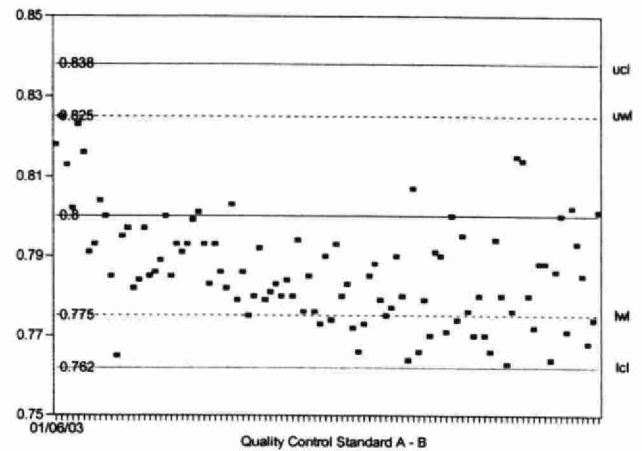
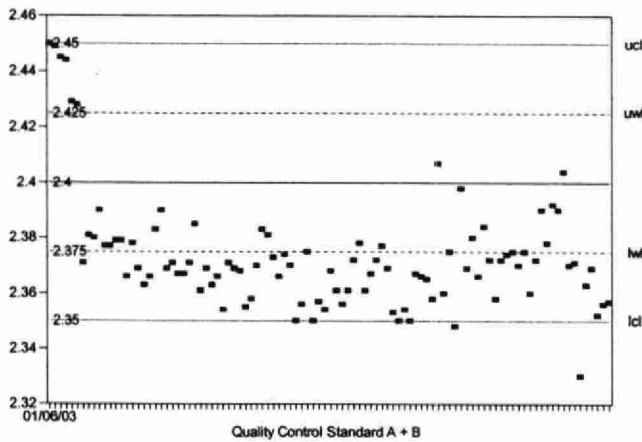
DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
216	0.00 - 0.20	0.0049	5.9
26	0.21 - 0.40	0.0067	2.2
33	0.41 - 1.00	0.0064	1.0
13	1.01 - 2.00	0.0187	1.4
288	Overall	0.0065	

FLUORIDE (E3172)

QUALITY CONTROL DATA FROM 01/06/03 TO 12/22/03

Analytical Range: to 2.0 mg/L as F



Note: For explanation of any exceedence, refer to raw data file

NITRATE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3004	Units	$\mu\text{g}/\text{m}^3$ as NO_3
LIMS Product Code	ANION3004	Supervisor	P. Wilson
Sample Type/Matrix	Air; HiVol Glass Fibre, Quartz and Polyflon, Other Filters and Puff		

SAMPLING:

Quantity Required	3/4" or 1.9cm strip from 8"x10" filter
Container	50 mL polypropylene tube

SAMPLING PREPARATION:

A 3/4" strip is cut in pieces and deposited into a 50 mL polypropylene tube. 50 mL of Pure-Water is added to the tube. The tube is placed on a horizontal shaker for approximately 1 hour. The supernatant is then filtered into a 15 mL plastic tube and analysed.

ANALYTICAL PROCEDURE:

Nitrate separated from other anions in the sample by automated suppressed ion chromatography using an eluent mixture of sodium bicarbonate and sodium carbonate and a conductivity detector. The concentration of nitrate (mg/L) is determined by the comparison of the analyte peak area count to that of a series of standards. The analyte result is corrected for the filter blank before the final calculation is made. The result is reported as $\mu\text{g}/\text{m}^3$ as NO_3 .

Chloride and sulphate are determined simultaneously.

INSTRUMENTATION:

Horizontal Shaker, ion chromatographic system plus a PC with ChromPerfect software and DT2804 card for automated sample injection, timing, and data processing.

REPORTING:

Maximum Significant Figures: 3	Current W value: $0.1 \mu\text{g}/\text{m}^3$	Current T value: $0.5 \mu\text{g}/\text{m}^3$
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CALIBRATION:

6 standards

CONTROLS:

Calibration	MB, IS(n), CS1, CS2, QCA and QCB
Drift	Duplicate plus 2 standards approximately every 20 samples
Recovery	CS3, CS4 & CS5

Note: IS(n) calibration controls were discontinued on August 15, 2003.

CS3 recovery control was discontinued on February, 2003.

QCA & QCB are put on line since June, 2003.

NOTES:

To convert unit from mg/L to $\mu\text{g}/\text{m}^3$, the final concentration of NO_3 in mg/L is multiplied by the following formula:

$$\text{Result (mg/L)} \times 50\text{mL} \times (63/6.75) / \text{air volume} = \mu\text{g}/\text{m}^3$$

Where: 63 is the area of the filter exposed and 6.75 is the sample aliquot area in square inch.

NITRATE (E3004)

QUALITY CONTROL DATA FOR 2003

Analytical Range: to 100 mg/L as NO₃

CALIBRATION CONTROL:

Quality Control Data for 06/25/03 to 12/11/03

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	25	80	81.223	1.223	0.3179
B:	25	20	20.316	0.316	0.1248
A+B:		100	101.539	1.539	0.3330
A-B:		60	60.907	0.907	0.3498

s.d.(AB) S(between runs): 0.2415 Sw(within run): 0.2474 S/Sw: 0.98

The calibration is accepted if the calibration control values obtained lie within the ranges:

100.11 - 102.97 for A+B
59.84 - 61.98 for A-B

Certified Reference standard data for 01/03/03 to 08/06/03:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
IS1	41	13.03	13.07	0.04	0.1509
IS2	41	11.98	12.02	0.04	0.1576
IS3	41	32.29	32.65	0.36	0.3415
IS4	41	89.59	90.84	1.25	0.8783

The standards are accepted if the control values obtained lie within the ranges:

12.32 - 13.73 for IS1
11.46 - 12.50 for IS2
31.51 - 33.07 for IS3
85.58 - 93.60 for IS4

In House Control standard data for 01/08/03 to 11/27/03:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
CS4	36	11.97	12.22	0.25	0.2225
CS5	36	16.12	16.19	0.07	0.1737

The standards are accepted if the control values obtained lie within the ranges:

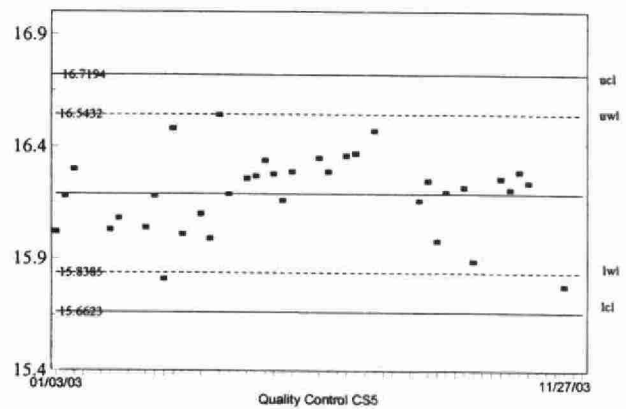
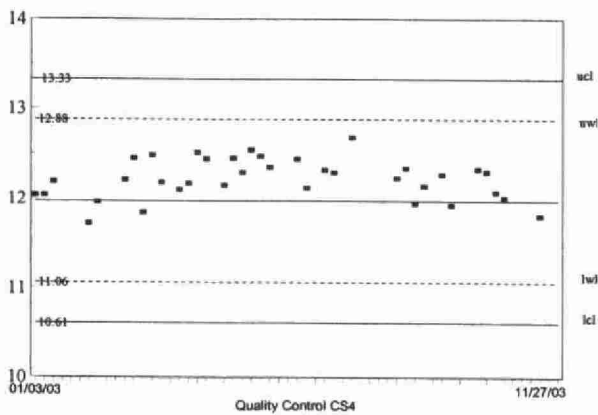
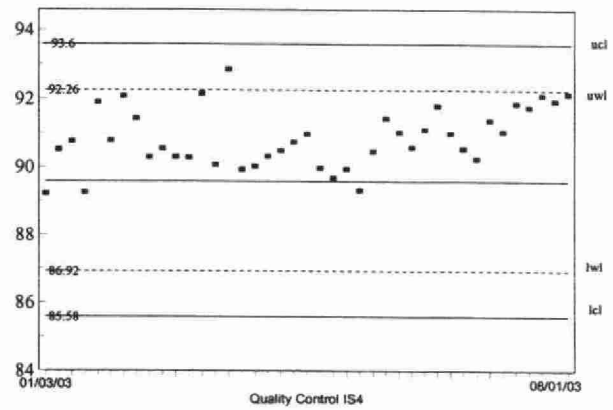
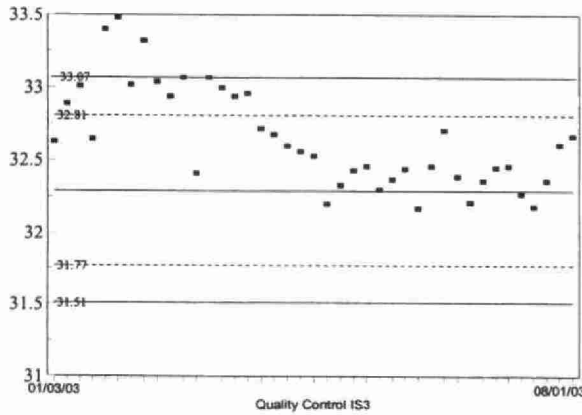
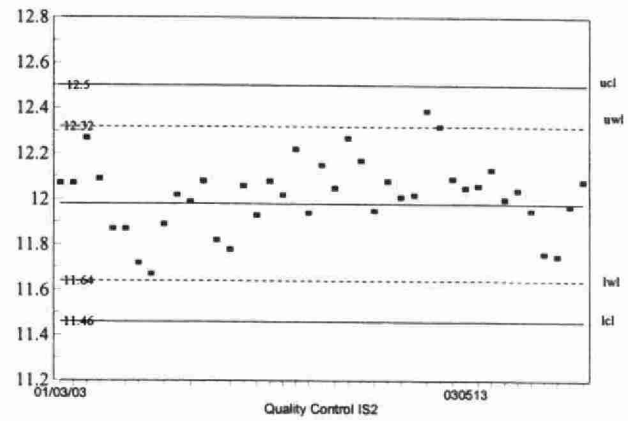
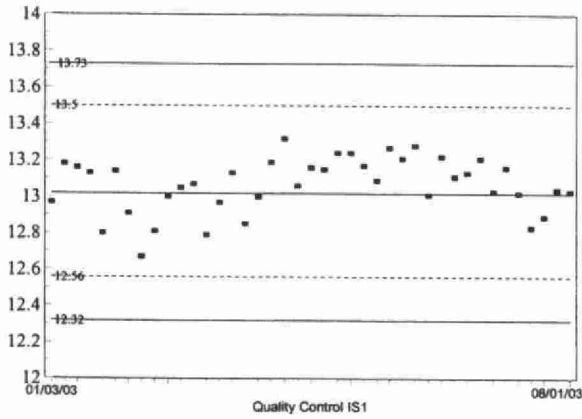
10.61 - 13.33 for CS4
15.66 - 16.72 for CS5

DUPLICATES:

n Data Pairs	Sample Concentration Span ($\mu\text{g}/\text{m}^3$)	Standard Deviation (2)	Coefficient of variation(%)
70	0.00 - 2.86	0.0784	9.7
16	2.89 - 7.15	0.1075	2.4
10	7.18 - 14.31	0.1533	1.5
0	14.33 - 28.61	N.A.	N.A.
96	Overall	0.0462	

NITRATE (E3004)

QUALITY CONTROL DATA FOR 2003
Analytical Range For IS Controls: to 100 mg/L
Analytical Range For CS Controls: to 28.61 $\mu\text{g}/\text{m}^3$

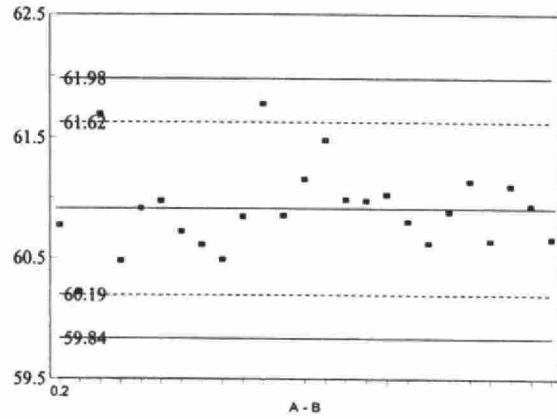
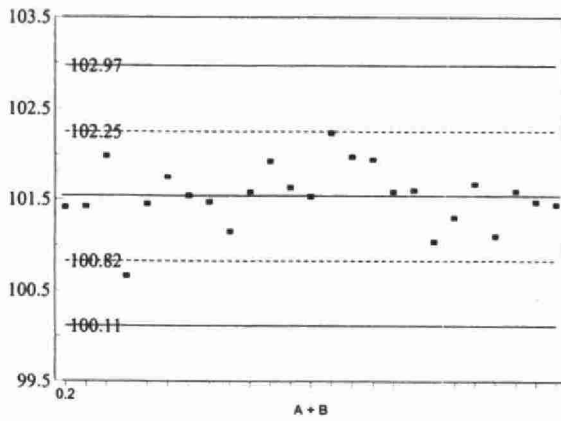


Note: For explanation of any exceedence, refer to raw data file.

NITRATE (E3004)

QUALITY CONTROL DATA FROM 06/25/03 TO 12/11/03

Analytical Range: to 100 mg/L



NITRILOTRIACETIC ACID

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	04/17/98
Method Reference No.	E3406	Reporting Unit	mg/L as NTA
LIMS Product Code	NTA3406, TCLPNTA3406	Supervisor	P. Wilson
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Nitrilotriacetic Acid is separated from other anions in the samples by automated suppressed gradient ion chromatography. A sodium hydroxide eluent is used with conductivity detection. The concentration of Nitrilotriacetic acid in mg/L as NTA is determined by comparison of the sample scan to a series of standard scans.

INSTRUMENTATION:

Basic modular continuous flow ion chromatographic system with gradient flow control module .

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.01	Current T value: 0.05
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 2 standards, e.g. QCA
Drift	1 standard every 10 samples
Spike	1 blank plus 3 samples

NOTE:

LIMS product code TCLPNTA3406 was added, April 2001.

NITRILOTRIACETIC ACID (E3406)

QUALITY CONTROL DATA FROM 01/13/03 TO 12/23/03

Analytical Range: to 1.00 mg/L as NTA

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	31	0.80	0.801	0.001	0.0081
B:	31	0.20	0.200	0.000	0.0080
A+B:		1.00	1.001	0.001	0.0116
A-B:		0.60	0.601	0.001	0.0110

s.d.(AB) S(between runs): 0.0080 Sw(within run): 0.0078 S/Sw: 1.03

The calibration is accepted if the calibration control values obtained lie within the ranges:

0.95 - 1.05 for A+B
0.56 - 0.64 for A-B

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
67	0.00 - 0.10	0.0004	17.6
4	0.10 - 0.20	0.0079	5.3
3	0.20 - 0.50	0.0069	2.2
0	0.50 - 1.00	N.A.	N.A.
74	Overall	0.0023	

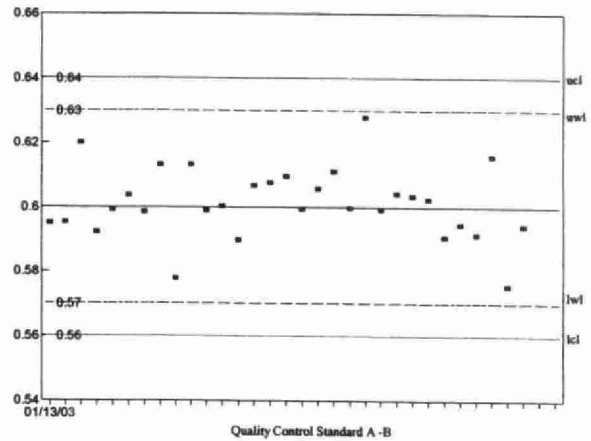
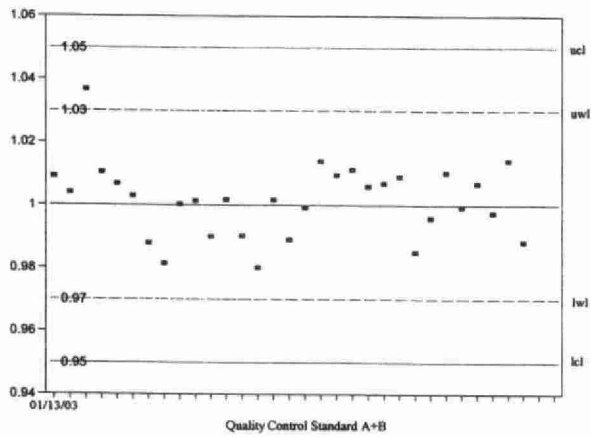
RECOVERY STANDARD:

	n	Expected Concentration (mg/L)	Mean Concentration	Standard Deviation (1)
Spiking Standard	135	0.10	0.103	0.0105

NITRILOTRIACETIC ACID (E3406)

QUALITY CONTROL DATA FROM 01/13/03 TO 12/23/03

Analytical Range: to 1.00 mg/L as NTA



NITROGEN, AMMONIA PLUS AMMONIUM

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3364	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3364	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Ammonia plus ammonium ions are determined on the supernatant of a settled sample via the formation of indophenol blue in a buffered system using nitroprusside as a catalyst. A reference stream, which differs from the colour formation stream by replacement of the catalyst with an equal flow of water, is employed to suppress sample matrix effects.

Approximate absorbance: 0.5 at the full scale level.

Nitrate plus nitrite, nitrite, and reactive orthophosphate are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus the following modules: 2 of 38°C heating bath (7.7 mL delay). Colourimetric measurement is through a 1.5 cm. light path at 630 nm.

Data capture and processing via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.002	Current T value: 0.010
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL, standard, and BL after every 10 samples

NOTES:

The HP data capture / processing system was replaced by Labtronics in August 1999.

Nitrogen; ammonia+ammonium (E3364)

Analytical Range : to 2 mg/L as N

CALIBRATION CONTROL:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	109	1.6	1.6005	0.0005	0.0091
B	109	0.8	0.7978	-0.0022	0.0071
C	109	0.16	0.1592	-0.0008	0.0046
A + B		2.4	2.3983	-0.0017	0.0143
A - B		0.8	0.8027	0.0027	0.008
B + C		0.96	0.957	-0.003	0.0098
B - C		0.64	0.6386	-0.0014	0.0068

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0082
	Within Runs	0.0057
	Between/Within	1.4386

s.d.(BC)	Between Runs	0.006
	Within Runs	0.0048
	Between/Within	1.25

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	2.424	2.376	2.447	2.353
A - B	0.824	0.776	0.835	0.765
B + C	0.974	0.946	0.989	0.9331
B - C	0.654	0.626	0.662	0.618

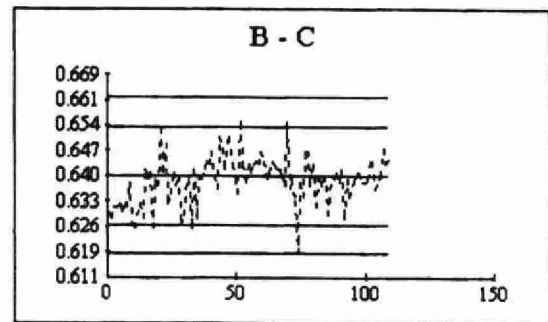
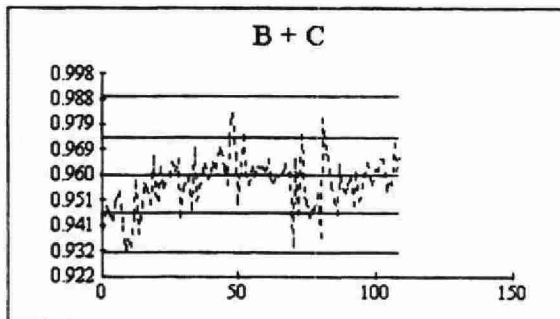
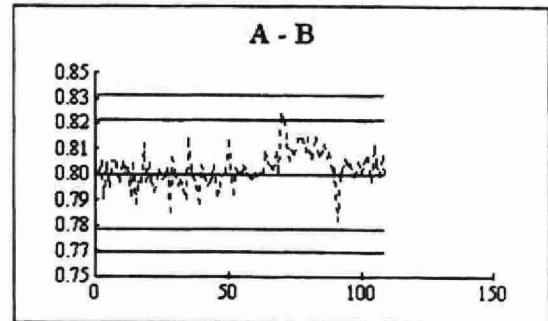
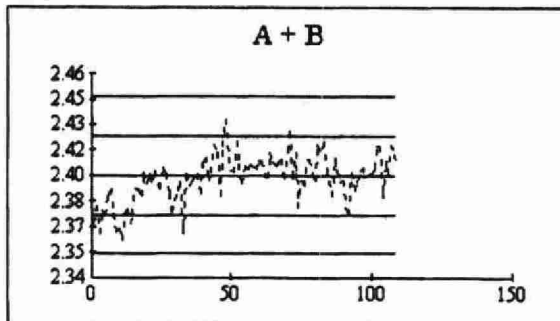
Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
274	0 - 10%	0.005	20.7
19	10 - 20%	0.007	2.5
8	20 - 50%	0.013	1.9
4	50 - 100%	0.056	3.8
305	Total	0.008	10.5

Other Checks	Number	Mean	Std. Dev.
LTB	109	0.0046	0.0047

Nitrogen; ammonia+ammonium [E3364A]

QC Data; 1/1/03 to 12/31/03



NITROGEN, AMMONIA PLUS AMMONIUM

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/77
Method Reference No.	E3366	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3366	Supervisor	P.Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Leachate, Ground Water.		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Ammonia plus ammonium ions are determined on the supernatant of a settled sample via the formation of indophenol blue in a buffered system using nitroprusside as a catalyst.

Approximate absorbance: 0.7 at the full scale level.

Reactive orthophosphate, nitrogen-nitrite and nitrogen-nitrate plus nitrite are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus one 38°C heating bath (7.7 mL delay).

Colourimetric measurement is through a 1.5 cm. light path at 630 nm. Data capture and processing via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.05	Current T value: 0.25
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL , standard and BL every 10 samples

NOTES:

The HP capture / processing system was replaced by Labtronics in October 1999.

Nitrogen; ammonia+ammonium (E3366)

Analytical Range : to 50.0 mg/L as N

CALIBRATION CONTROL:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	58	40	39.7867	-0.2133	0.1738
B	58	20	20.0105	0.0105	0.0967
C	58	4	3.9545	-0.0455	0.0485
A + B		60	59.7972	-0.2028	0.213
A - B		20	19.7762	-0.2238	0.1836
B + C		24	23.965	-0.035	0.1252
B - C		16	16.056	0.056	0.088

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.1406
	Within Runs	0.1298
	Between/Within	1.0832

s.d.(BC)	Between Runs	0.0765
	Within Runs	0.0622
	Between/Within	1.2299

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	60.62	59.38	61.2	58.76
A - B	20.62	19.38	20.9	19.07
B + C	24.33	23.67	24.7	23.34
B - C	16.33	15.67	16.5	15.5

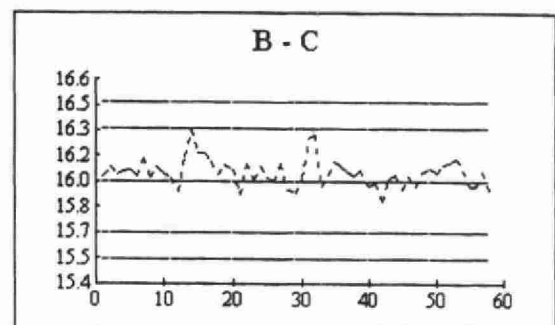
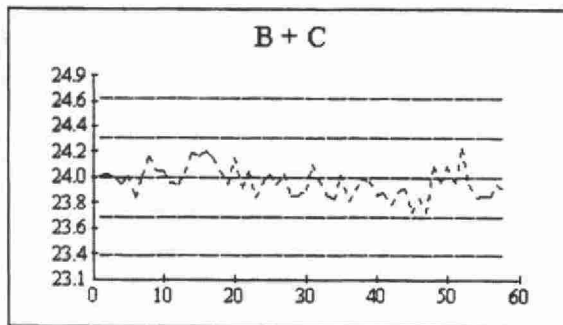
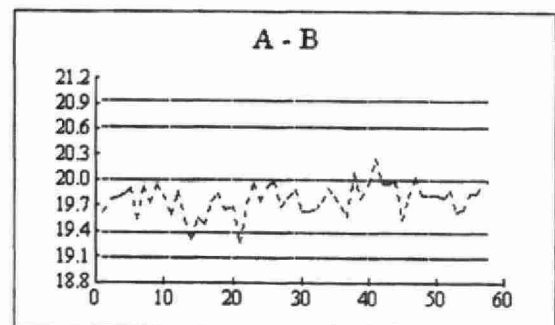
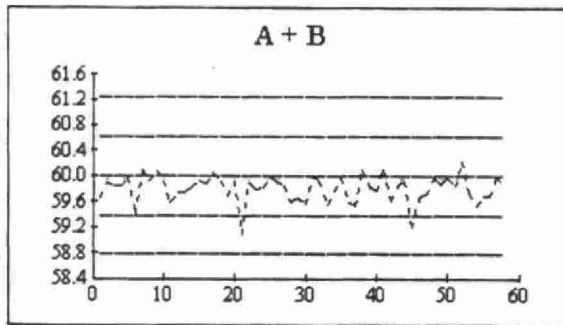
Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
123	0 - 10%	0.035	6.9
6	10 - 20%	0.05	0.7
18	20 - 50%	0.084	0.6
0	50 - 100%	NA	NA
147	Total	0.045	1.8

Other Checks	Number	Mean	Std. Dev.
LTB	58	-0.0209	0.0183

Nitrogen; ammonia+ammonium (E3366A)

QC Data: 1/1/03 to 12/31/03



NITROGEN, NITRATE PLUS NITRITE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3364	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3364	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Nitrate plus nitrite is determined on the supernatant of a settled sample. Nitrate is reduced to nitrite in alkaline media at 37°C, by hydrazine sulphate with copper as a catalyst. Colourimetry is based on the formation of an azo dye by nitrite, sulphanilamide, and N(1-naphthyl) ethylenediamine dihydrochloride. To control metal ion interference, samples are passed through an ion-exchange column prior to the reduction step. Approximate absorbance: 0.6 at the full scale level.

Ammonia plus ammonium, nitrite, and reactive orthophosphate are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus the following modules: 38°C heating bath (7.7 mL delay), ion exchange column. Colourimetric measurement is through a 1.5 cm. light path at 520 nm. Data capture and processing via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.005	Current T value: 0.025
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL, standard and BL every 10 samples
Interference	Nitrate standard spiked with calcium (150 mg/L) and magnesium (50 mg/L) confirms effective interference suppression.
Recovery	Individual nitrate and nitrite standards of equal N concentration show effectiveness of reduction step.

NOTES: The HP data capture / processing system was replaced by Labtronics in August 1999.

Nitrogen; nitrate+nitrite (E3364)

Analytical Range : to 5.0 mg/L as N

CALIBRATION CONTROL:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	110	4	3.9928	-0.0072	0.0256
B	110	2	1.9954	-0.0046	0.015
C	110	0.4	0.393	-0.007	0.0054
A + B		6	5.9883	-0.0117	0.0311
A - B		2	1.9974	-0.0026	0.0281
B + C		2.4	2.3885	-0.0115	0.0182
B - C		1.6	1.6024	0.0024	0.0133

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.021
	Within Runs	0.0199
	Between/Within	1.0553

s.d.(BC)	Between Runs	0.0113
	Within Runs	0.0094
	Between/Within	1.2021

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	6.066	5.944	6.132	5.868
A - B	2.066	1.934	2.099	1.901
B + C	2.436	2.364	2.472	2.328
B - C	1.636	1.564	1.654	1.546

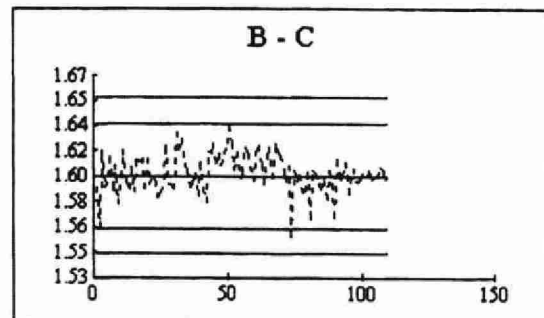
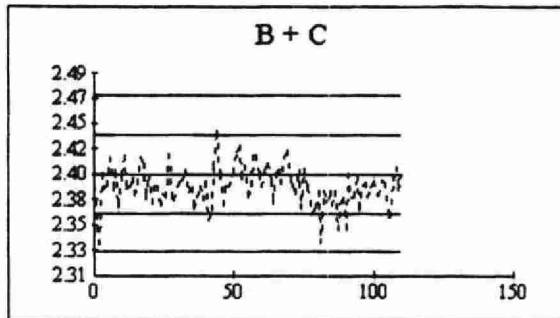
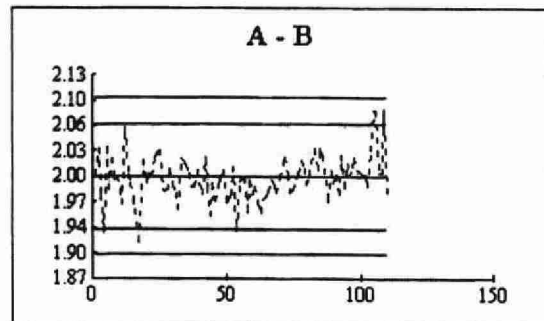
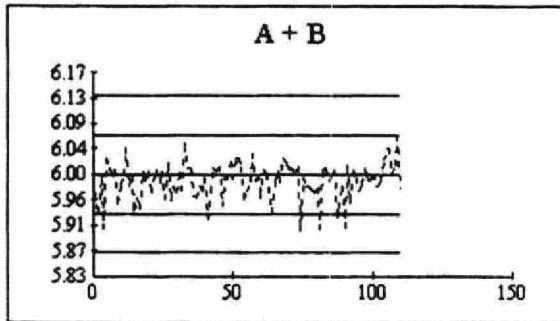
Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
196	0 - 10%	0.005	2.8
41	10 - 20%	0.008	1.1
27	20 - 50%	0.013	0.8
22	50 - 100%	0.028	0.8
286	Total	0.01	1.6

Other Checks	Number	Mean	Std. Dev.
LTB	110	-0.0003	0.0023

Nitrogen: nitrate+nitrite (E3364A)

QC Data: 1/1/03 to 12/31/03



NITROGEN, NITRATE PLUS NITRITE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3366	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3366,TCLPNOT3366	Supervisor	P.Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Leachate, Ground Water.		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Nitrate plus nitrite is determined on the supernatant of a settled sample. Nitrate is reduced to nitrite in alkaline media at 38°C, by hydrazine sulphate with copper as a catalyst. Colourimetry is based on the formation of an azo dye by nitrite, sulphanilamide, and N(1-naphthyl) ethylenediamine dihydrochloride. To control metal ion interference, samples are passed through an ion-exchange column prior to the reduction step. Approximate absorbance: 0.7 at the full scale level.

Ammonia plus ammonium, nitrite, and reactive phosphate are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system plus the following modules: 38°C heating bath (7.7 mL delay). Colourimetric measurement is through a 1.5 cm. light path at 520 nm. Two analytical ranges are obtained from the output of the colourimeter. Data capture and processing via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.05	Current T value: 0.25
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL ,standard and BL every 10 samples
Interference	Nitrate standard spiked with calcium (150 mg/L) and magnesium (50mg/L) confirms effective interference suppression.
Recovery	Individual nitrate and nitrite standards of equal N concentration show effectiveness of reduction step.

NOTES: The HP capture / processing system was replaced by Labtronics in October 1999.
LIMS product code TCLPNOT3366 was added in April 2001.

Nitrogen; nitrate+nitrite (E3366)

Analytical Range : to 50.0 mg/L as N

CALIBRATION CONTROL:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	59	40	39.9575	-0.0425	0.246
B	59	20	20.1002	0.1002	0.1593
C	59	4	4.0244	0.0244	0.0584
A + B		60	60.0576	0.0576	0.2992
A - B		20	19.8573	-0.1427	0.2868
B + C		24	24.1246	0.1246	0.1811
B - C		16	16.0758	0.0758	0.1574

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.2072
	Within Runs	0.2028
	Between/Within	1.0217

s.d.(BC)	Between Runs	0.12
	Within Runs	0.1113
	Between/Within	1.0782

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	60.67	59.33	61.3	58.66
A - B	20.67	19.33	21	18.99
B + C	24.36	23.64	24.7	23.26
B - C	16.36	15.64	16.5	15.46

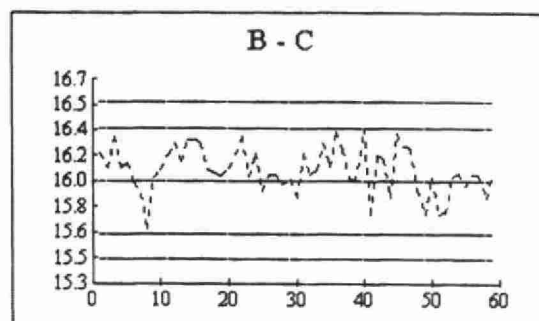
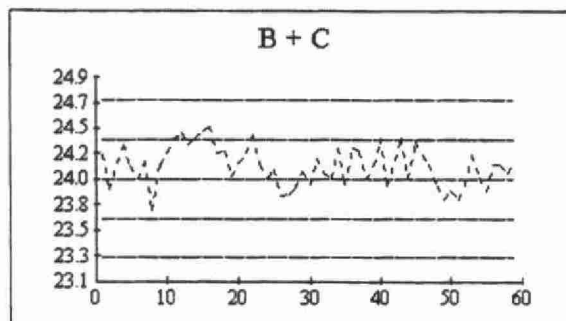
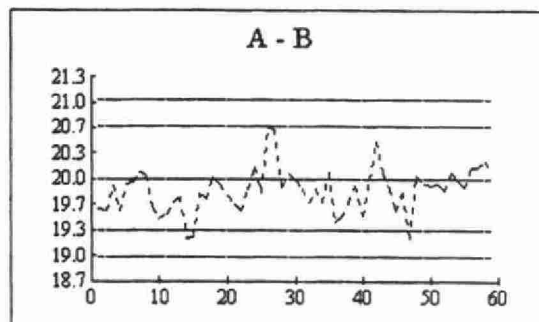
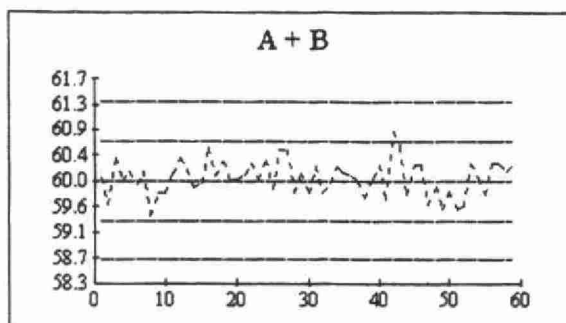
Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
115	0 - 10%	0.026	3
21	10 - 20%	0.083	1.1
18	20 - 50%	0.13	0.9
7	50 - 100%	0.212	0.7
161	Total	0.072	1.5

Other Checks	Number	Mean	Std. Dev.
LTB	59	-0.0117	0.0134

Nitrogen; nitrate+nitrite (E3366A)

QC Data; 1/1/03 to 12/31/03



NITROGEN, NITRITE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3364	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3364	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Nitrite is determined on the supernatant of a settled sample by formation of an azo dye using sulphanilamide, and N(1-naphthyl) ethylenediamine dihydrochloride.

Approximate absorbance: 0.6 at the full scale level.

Ammonia plus ammonium, nitrate plus nitrite, and reactive orthophosphate are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 520 nm.

Data capture and processing via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.001	Current T value: 0.005
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL, standard and BL after every 10 samples
Interference	Nitrate standard spiked with calcium (150 mg/L) and magnesium (50 mg/L) confirms effective interference suppression.
Recovery	Individual nitrate and nitrite standards of equal N concentration show effectiveness of reduction step.

NOTES:

The HP data capture / processing system was replaced by Labtronics in August 1999.

Nitrogen; nitrite (E3364)

Analytical Range : to 0.200 mg/L as N

CALIBRATION CONTROL:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	111	0.16	0.1584	-0.0016	0.0015
B	111	0.08	0.0796	-0.0004	0.0009
C	111	0.016	0.0162	0.0002	0.0007
A + B		0.24	0.238	-0.002	0.0018
A - B		0.08	0.0788	-0.0012	0.0017
B + C		0.096	0.0958	-0.0002	0.0013
B - C		0.064	0.0634	-0.0006	0.001

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0012
	Within Runs	0.0012
	Between/Within	1

s.d.(BC)	Between Runs	0.0008
	Within Runs	0.0007
	Between/Within	1.1429

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	0.243	0.237	0.247	0.235
A - B	0.083	0.077	0.084	0.076
B + C	0.098	0.094	0.101	0.092
B - C	0.066	0.062	0.067	0.061

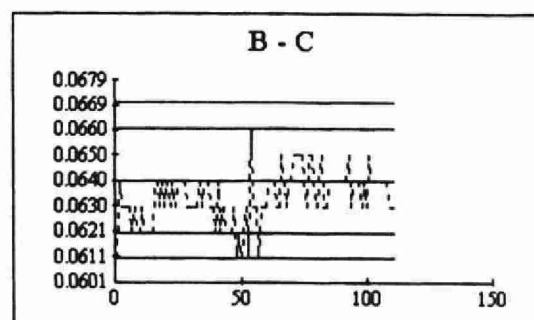
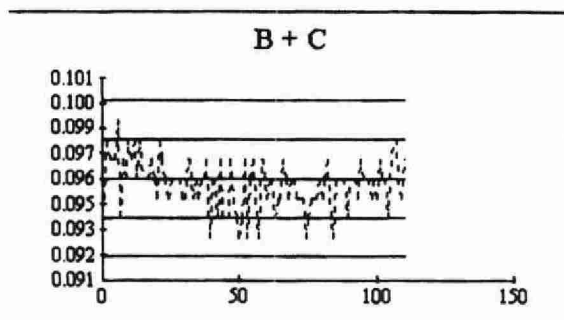
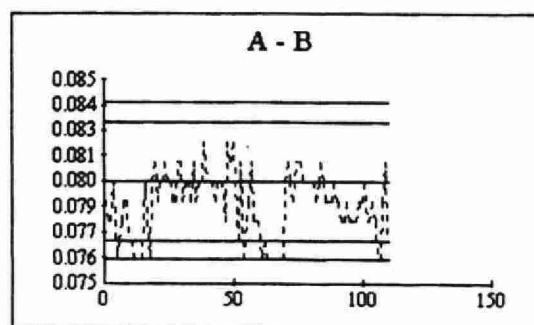
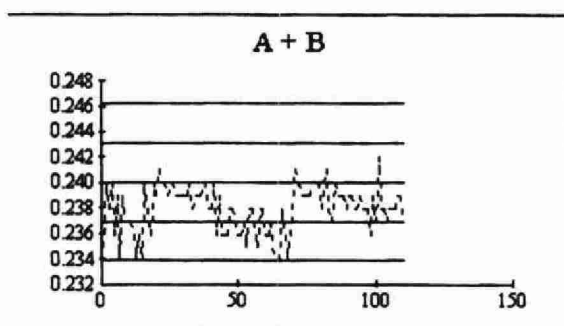
Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
209	0 - 10%	0.001	21.8
34	10 - 20%	0.003	10.4
10	20 - 50%	0.001	1.5
4	50 - 100%	0.039	30.9
257	Total	0.005	41.5

Other Checks	Number	Mean	Std. Dev.
LTB	111	0.0007	0.001

Nitrogen: nitrite (E3364A)

QC Data: 1/1/03 to 12/31/03



NITROGEN, NITRITE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/78
Method Reference No	E3366	Reporting Unit	mg/L as N
LIMS Product Code	DISNUT3366	Supervisor	P.Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Leachate, Ground Water.		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Nitrite is determined on the supernatant of a settled sample by formation of an azo dye using sulphanilamide, and N(1-naphthyl) ethylenediamine dihydrochloride.

Approximate absorbance: 0.3 at the full scale level.

Ammonia plus ammonium, nitrate plus nitrite, and reactive orthophosphate are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 520 nm. Data capture and processing via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.005	Current T value: 0.025
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL ,standard and BL every 10 samples
Interference	Nitrate standard spiked with calcium (150 mg/L) and magnesium (50 mg/L) confirms effective interference suppression.
Recovery	Individual nitrate and nitrite standards of equal N concentration show effectiveness of reduction step.

NOTES:

The HP capture / processing system was replaced by Labtronics in October 1999.

Nitrogen; nitrite (E3366)

Analytical Range : to 2.00 mg/L as N

CALIBRATION CONTROL:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	58	1.6	1.5821	-0.0179	0.0072
B	58	0.8	0.7921	-0.0079	0.0041
C	58	0.16	0.1581	-0.0019	0.004
A + B		2.4	2.3741	-0.0259	0.0086
A - B		0.8	0.79	-0.01	0.0079
B + C		0.96	0.9502	-0.0098	0.0063
B - C		0.64	0.634	-0.006	0.0049

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0059
	Within Runs	0.0056
	Between/Withi n	1.0536

s.d.(BC)	Between Runs	0.004
	Within Runs	0.0035
	Between/Withi n	1.1429

Control Limits

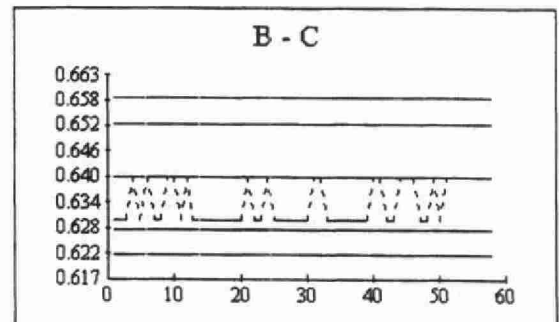
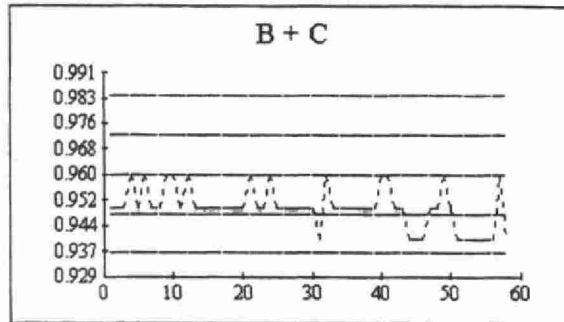
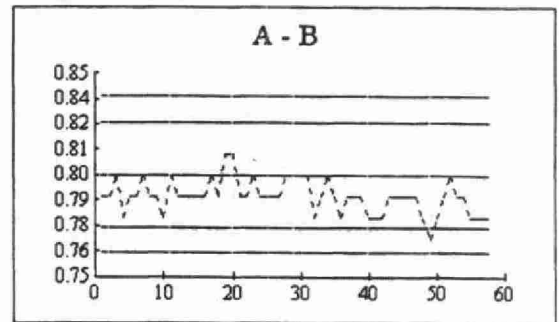
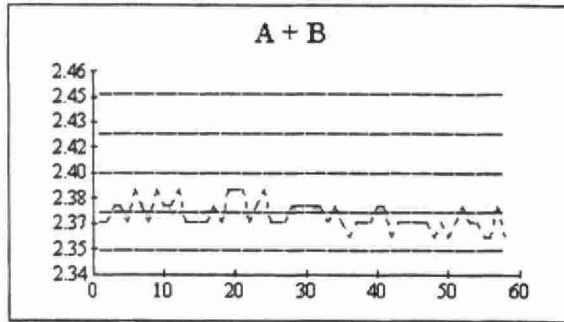
Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	2.424	2.376	2.448	2.353
A - B	0.824	0.776	0.836	0.764
B + C	0.972	0.948	0.984	0.936
B - C	0.652	0.628	0.658	0.622

Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
74	0 - 10%	0.003	6.4
9	10 - 20%	0.009	2.7
7	20 - 50%	0.013	1.7
4	50 - 100%	0.005	0.3
94	Total	0.005	2.6

Nitrogen; nitrite (E3366A)

QC Data: 1/1/03 to 12/31/03



NITROGEN, TOTAL KJELDAHL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Mar '89
Method Reference No.	E3116	Reporting Unit	mg/g as N
LIMS Product Code	TNP3116	Supervisor	P. Wilson
Sample Type/Matrix	Soil, Sediment, Dried Sludge		

SAMPLING:

Quantity Required	0.08 to 0.4 g
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Nitrogen compounds are converted to simple inorganic forms by dissolution of the samples in hot sulphuric acid and potassium persulphate. Potassium persulphate is added later in the digestion to raise the boiling point and to provide a highly oxidizing environment to decompose the more resistant organic matter. The digestate is filtered and the filtrate is analyzed using an automated colourimetric system.

INSTRUMENTATION:

Hot plate .

Basic automated modular continuous flow system : 37.5°C bath. Colourimetric measurement is through a 5 cm. light path at 630 nm.

Data capture and processing via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.1	Current T value: 0.5
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CALIBRATION:

3 High and 2 Low Calibration Standards

CONTROLS:

Calibration	In house composite B-Soil/sediment, QC Soils/Sediment (RS92), QCA, QCB & QCC
Drift	4 BL's per run; high and low calibration standard at the end of the run
Recovery	1 digested BL plus 4 digested standards

NOTES:

System is calibrated with undigested standards. QCA, QCB and QCC are implemented in April 2003. Low Recoveries for the Domestic Sludge SRM 2781 are under investigation.

NITROGEN, TOTAL KJELDAHL (E3116)

QUALITY CONTROL DATA FROM 01/18/01 TO 12/16/03

Analytical Range: to 10 mg/L as N

QUALITY CONTROL:

Data for 2003 only

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	20	8	8.04	0.04	0.0634
B:	20	4	3.98	-0.02	0.0293
C:	20	1	0.99	-0.01	0.0166
A+B:		12	12.02	0.02	0.0807
A-B:		4	4.06	0.06	0.0649
B+C:		5	4.97	-0.03	0.0377
B-C:		3	2.98	-0.02	0.0291

s.d.(AB) S(between runs): 0.05

Sw(within run): 0.05

S/Sw: 1.08

s.d.(BC) S(between runs): 0.02

Sw(within run): 0.02

S/Sw: 1.16

The calibration is accepted if the calibration control values obtained lie within the ranges:

11.6	-	12.4	for	A+B
3.7	-	4.3	for	A-B
4.76	-	5.24	for	B+C
2.82	-	3.18	for	B-C

	n	Expected Concentration (mg/g)	Mean Concentration	Standard Deviation (1)
RS92 - In House Soil Composite	130	1.69	1.54	0.1344
RSM-2781 -Domestic Sludge Certified	130	42.2	43.48	2.7354

Note: RS92 and RSM-2781 are run in duplicate for 2001 to 2003 (see graphs).

The run is accepted if the control values obtained lie within the ranges:

1.39	-	1.99	for	RS92
29.1	-	55.2	for	RSM-2781

RECOVERY STANDARDS

	n	Expected Concentration (mg/L)	Mean Concentration	Standard Deviation (1)
R1	65	5.25	5.25	0.1869
R2	65	1.75	1.73	0.0844

Note: R1 contain a single set of data for 2001 & 2002; two sets for 2003.
R2 contains a single set of data for 2001 and 2002 only.

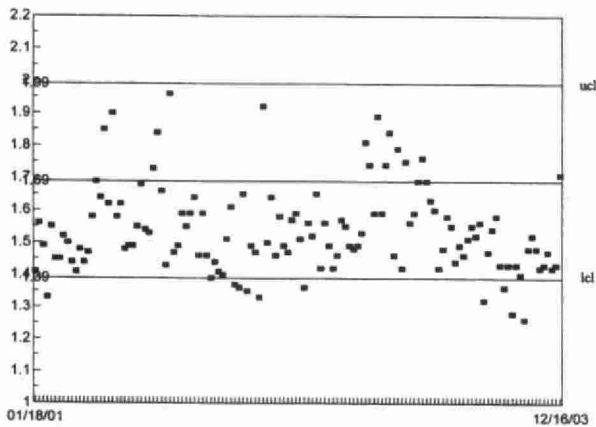
DUPLICATES: (Sediment/Soils)

n Data Pairs	Sample Concentration Span (mg/g)	Standard Deviation (2)	Coefficient of variation(%)
104	0.00 - 2.00	0.1043	9.7
29	2.01 - 4.00	0.1713	6.7
22	4.01 - 10.0	0.4577	7.4
8	10.1 - 20.0	0.7250	3.9
163	Overall	0.2574	

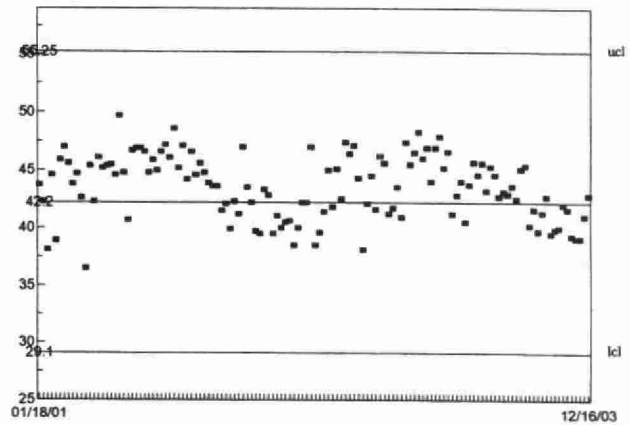
NITROGEN, TOTAL KJELDAHL (E3116)

QUALITY CONTROL DATA FROM 01/18/01 TO 12/16/03

Analytical Range: to 10 mg/g as N

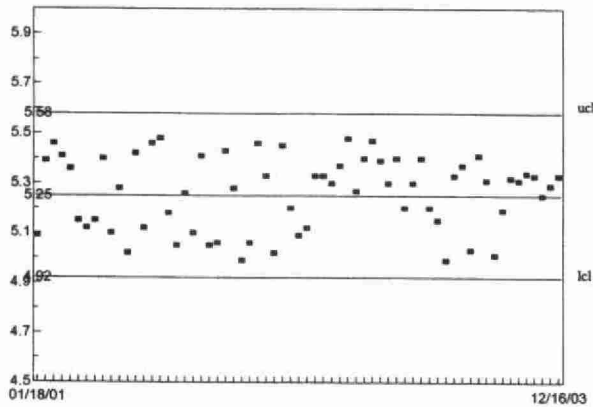


RS92 Sediment and Soil Control

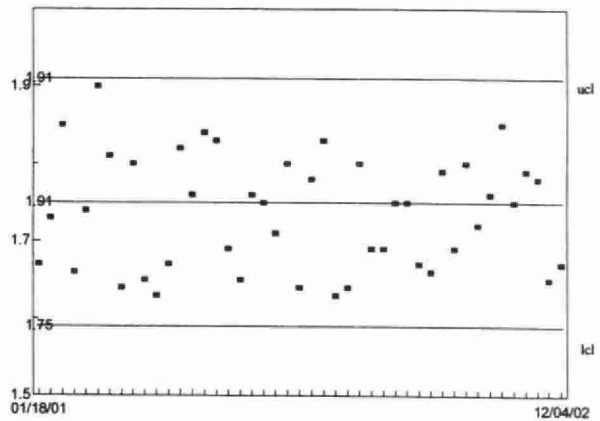


RSM2781 Domestic Sludge

Analytical Range: to 10 mg/L as N



R1 Recovery Sample

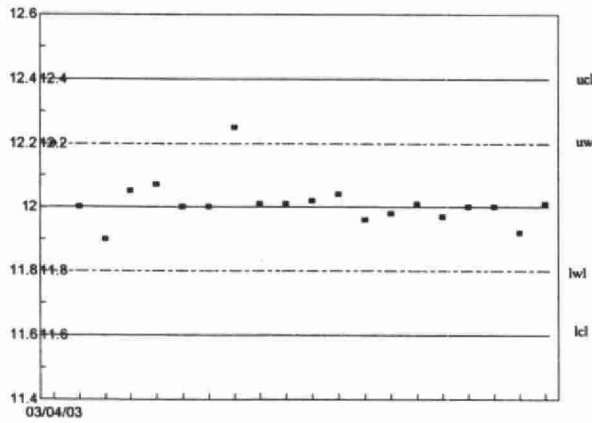


R2 Recovery Sample

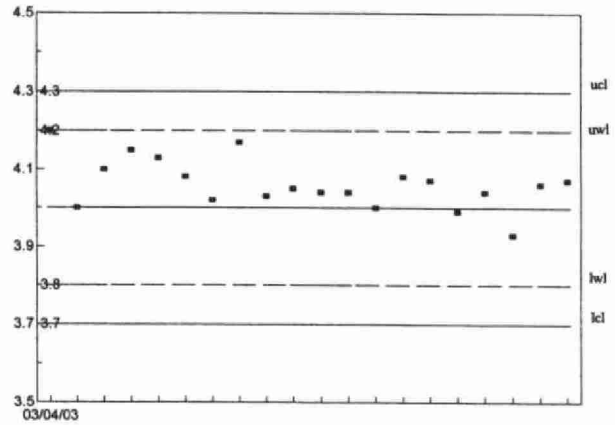
Note: The Quality Control Data for R2 Recovery Sample are from 01/18/01 to 12/04/02 only.
For explanation of any exceedence, refer to raw data file.

NITROGEN, TOTAL KJELDAHL (E3116)

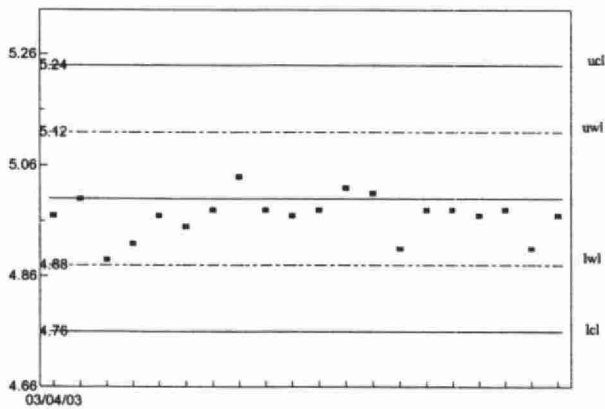
QUALITY CONTROL DATA FROM 04/03/03 TO 12/16/03



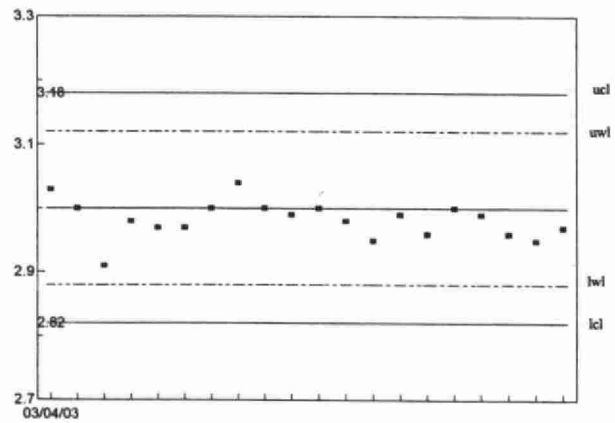
Quality Control Standard A+B



Quality Control Standard A - B



Quality Control Standard B+C



Quality Control Standard B - C

NITROGEN, TOTAL KJELDAHL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Mar '89
Method Reference No.	E3118	Reporting Unit	mg/g as N
LIMS Product Code	TNP3118	Supervisor	P. Wilson
Sample Type/Matrix	Vegetation, Moss Bag		

SAMPLING:

Quantity Required	0.02 to 0.04 g
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Nitrogen compounds are converted to simple inorganic forms by dissolution of the samples in hot sulphuric acid and potassium persulphate. Potassium persulphate is added later in the digestion to raise the boiling point and to provide a highly oxidizing environment to decompose the more resistant organic matter. The digestate is analyzed using an automated colourimetric system.

INSTRUMENTATION:

Hot plate.

Basic automated modular continuous flow system : 37.5°C bath. Colourimetric measurement is through a 5 cm. light path at 630 nm.

Data capture and processing via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.20	Current T value: 1.00
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CALIBRATION:

3 High and 2 Low Calibration Standards

CONTROLS:

Calibration	In house composite A-VEG, QC VEG (Pine Needles), QCA, QCB & QCC
Drift	4 BL's per run; high and low calibration standard at the end of the run
Recovery	1 digested BL plus 4 digested standards

NOTES:

System is calibrated with undigested standards. QCA, QCB and QCC are introduced (April 2003).

NITROGEN, TOTAL KJELDAHL (E3118)

QUALITY CONTROL DATA FROM 01/18/01 TO 12/15/03

Analytical Range: to 10 mg/L as N

QUALITY CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	5	8	8.026	0.026	0.0472
B:	5	4	3.982	-0.018	0.0460
C:	5	1	0.982	-0.018	0.0192
A+B:		12	12.008	0.008	0.0870
A-B:		4	4.044	0.044	0.0336
B+C:		5	4.964	-0.036	0.0513
B-C:		3	3.000	0.000	0.0485

s.d.(AB) S(between runs): 0.05

Sw(within run): 0.02

S/Sw: 2.77

s.d.(BC) S(between runs): 0.03

Sw(within run): 0.02

S/Sw: 1.46

The calibration is accepted if the calibration control values obtained lie within the ranges:

11.6	-	12.4	for	A+B
3.7	-	4.3	for	A-B
4.76	-	5.24	for	B+C
2.82	-	3.18	for	B-C

	n	Expected Concentration (mg/g)	Mean Concentration (mg/g)	Standard Deviation (1)
Pine Needles	38	12.1	11.45	0.544

The run is accepted if the control values obtained lie within the ranges:

10.3 - 13.9 for Pine Needles

Recovery Standards

	n	Expected Concentration (mg/L)	Mean Concentration (mg/L)	Standard Deviation (1)
R1	42	5.25	5.25	0.1707
R2	42	1.75	1.74	0.0733

Note: R1, R2 & Pine Needle contain data for 2001 to 2003.

QCA, QCB & QCC contain data for 2003 only.

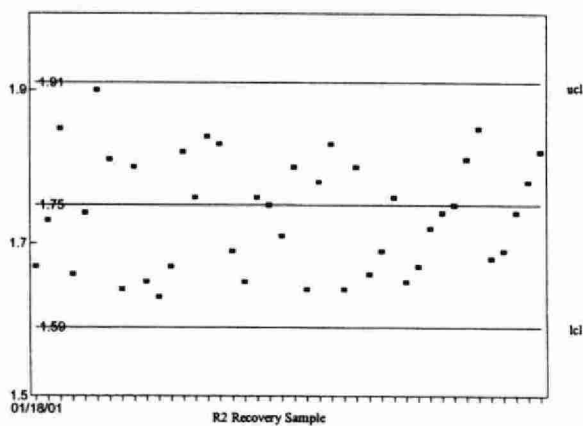
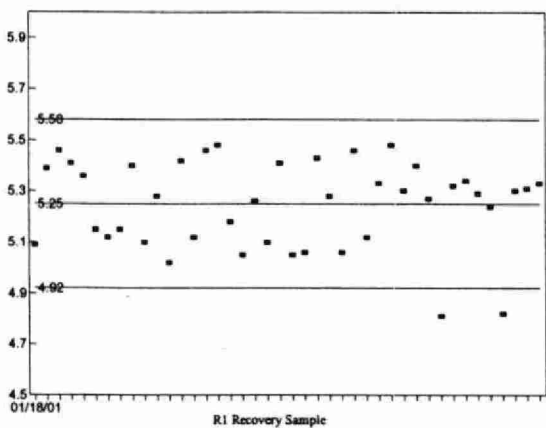
DUPLICATES: (VEGETATION)

n Data Pairs	Sample Concentration Span (mg/g)	Standard Deviation (2)	Coefficient of variation(%)
46	0.00 - 10.0	0.3176	12.0
13	10.1 - 20.0	0.6445	3.9
37	20.1 - 50.0	0.9896	3.4
96	Overall	0.6943	

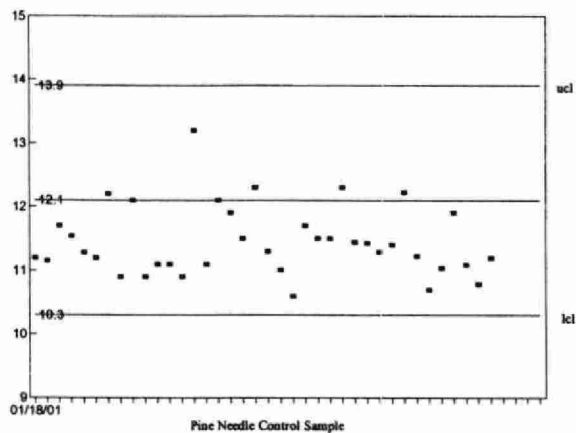
NITROGEN, TOTAL KJELDAHL (E3118)

QUALITY CONTROL DATA FROM 01/18/01 TO 12/15/03

Analytical Range : to 10 mg/Las N



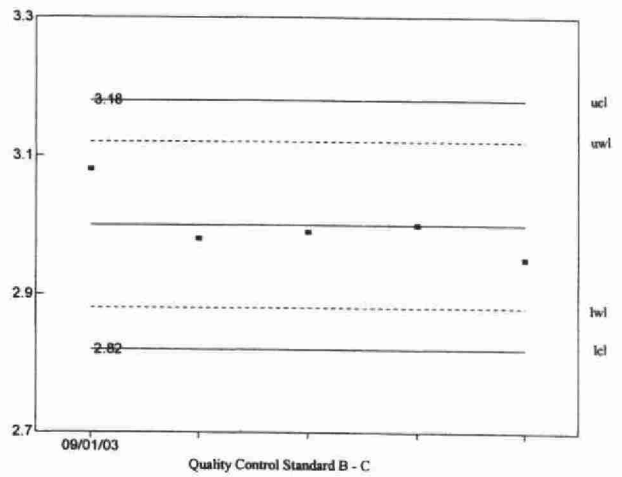
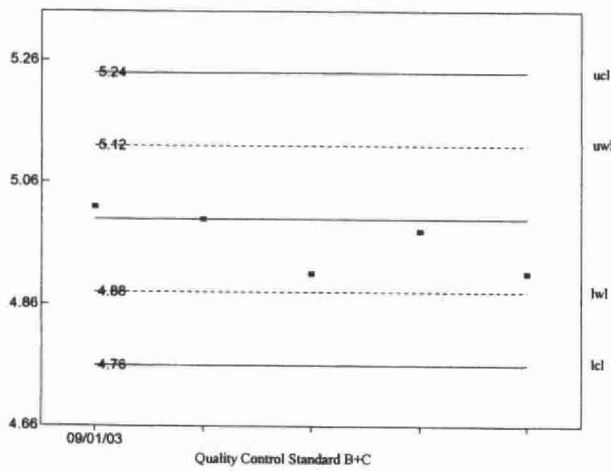
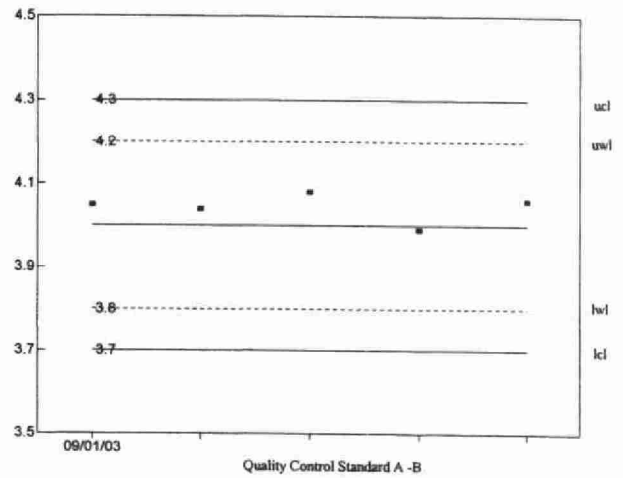
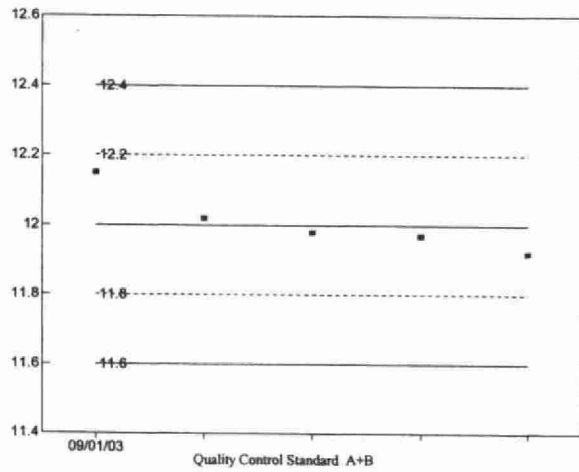
Analytical Range: to 10 mg/g as N



Note: For explanation of any exceedence, refer to raw data file.

NITROGEN, TOTAL KJELDAHL (E3118)

QUALITY CONTROL DATA FROM 01/09/03 TO 12/15/03



NITROGEN, TOTAL KJELDAHL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No.	E3367	Reporting Unit	mg/L as N
LIMS Product Code	TOTNUT3367	Supervisor	P.Wilson
Sample Type/Matrix	Precipitation, Drinking Water, Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Samples are digested in a sulphuric acid-mercuric oxide-potassium sulphate media using three block digestors kept at 180°C, 210°C and 360°C. The pH of the digestate is adjusted in-line in two stages and then ammonia is determined by formation of indophenol blue in a buffered system using nitroprusside as a catalyst.

Approximate absorbance: 0.3 at the full scale level.

Total phosphorus is determined simultaneously.

INSTRUMENTATION:

Three block digesters

Basic automated modular continuous flow system plus 1 module: 38°C bath (7.7 mL delay). Colourimetric measurement is through a 5.0 cm. light path at 630 nm.

Data capture and processing via a computer system

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.02	Current T value: 0.10
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CALIBRATION:

BL plus 7 undigested standards

CONTROLS:

Calibration	LTBL plus 3 undigested standards, e.g. QCA
Drift	BL, undigested standard, BL every 10 samples
Recovery	3 digested BL plus 3 digested standards in duplicate, e.g. R1

NOTE:

The HP capture / processing system was replaced by Labtronics in May 1999.

Nitrogen;total Kjeldahl (E3367)

Analytical Range : to 2.00 mg/L as N

CALIBRATION CONTROL:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	95	1.6	1.605	0.005	0.011
B	95	0.8	0.806	0.006	0.009
C	95	0.16	0.163	0.003	0.006
A + B		2.4	2.41	0.01	0.017
A - B		0.8	0.799	-0.001	0.011
B + C		0.96	0.969	0.009	0.012
B - C		0.64	0.642	0.002	0.01

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0102
	Within Runs	0.0078
	Between/Within	1.3077

s.d.(BC)	Between Runs	0.0077
	Within Runs	0.0071
	Between/Within	1.0845

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	2.44	2.376	2.48	2.32
A - B	0.84	0.76	0.86	0.74
B + C	0.984	0.936	1.007	0.913
B - C	0.663	0.617	0.675	0.605

Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
96	0 - 10%	0.011	8.3
96	10 - 20%	0.014	4.7
68	20 - 50%	0.031	5.3
11	50 - 100%	0.044	3.5
271	Total	0.021	6

Recoveries

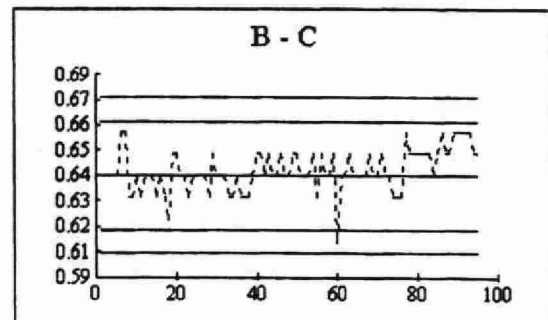
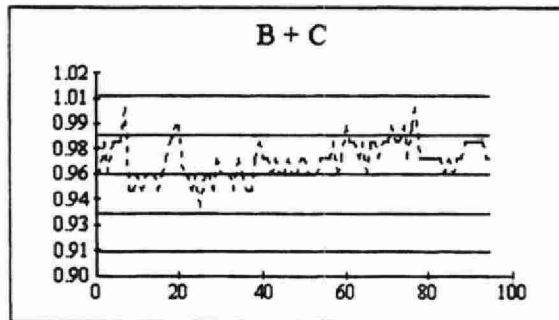
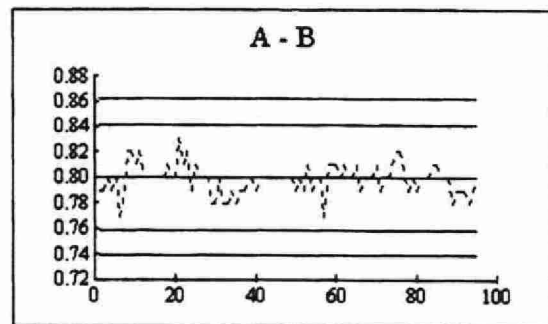
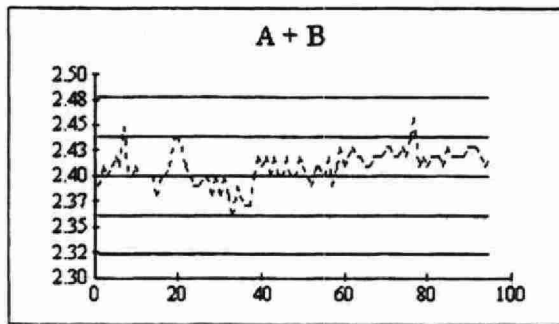
Number	Expected	Mean	Std. Dev.
91	1.4	1.405	0.023
91	0.84	0.844	0.018
91	0.28	0.285	0.014

Other Checks

	Number	Mean	Std. Dev.
LTB	95	0.001	0.005
Digested Blank	95	0.015	0.011

Nitrogen, total Kjeldahl (E3367A)

QC Data: 1/1/03 to 12/31/03



NITROGEN, TOTAL KJELDAHL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No	E3368	Reporting Unit	mg/L as N
LIMS Product Code	TOTNUT3368	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Raw Sewage, Industrial Waste, Effluent, Ground Water, Process Water, Leachate.		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Samples are digested in a sulphuric acid-mercuric oxide-potassium sulphate media using three block digestors kept at 180°C, 210°C and 360°C. The pH of the digestate is adjusted in-line in two stages and then ammonia is determined by formation of indophenol blue in a buffered system using nitroprusside as a catalyst.

Approximate absorbance: 1.1 at the full scale level.

Total phosphorus is determined simultaneously.

INSTRUMENTATION:

Three block digesters

Basic automated modular continuous flow system plus 1 module: 38°C bath (7.7 mL delay). Colourimetric measurement is through a 1.5 cm. light path at 630 nm.

Data capture and processing via a computer system

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.05	Current T value: 0.25
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CALIBRATION:

BL plus 7 undigested standards

CONTROLS:

Calibration	LTBL plus 3 undigested standards, e.g. QCA
Drift	BL every 10 samples; undigested standard every 20 samples
Recovery	3 digested BL plus 3 digested standards in duplicate, e.g. R1

NOTES:

System is calibrated with undigested standards.

The HP capture / processing system was replaced by Labtronics in April 1999.

Nitrogen; total Kjeldahl (E3368)

Analytical Range : to 50.0 mg/L as N

CALIBRATION CONTROL:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	53	40	39.997	0.003	0.162
B	53	20	20.139	0.139	0.074
C	53	4	3.945	0.055	0.052
A + B		60	60.135	0.135	0.185
A - B		20	19.858	0.142	0.171
B + C		24	24.084	0.084	0.096
B - C		16	16.194	0.194	0.085

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.126
	Within Runs	0.1209
	Between/Within	1.0422

s.d.(BC)	Between Runs	0.0642
	Within Runs	0.0601
	Between/Within	1.0682

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	60.36	59.64	60.73	59.27
A - B	20.36	19.64	20.55	19.45
B + C	24.21	23.79	24.42	23.58
B - C	16.21	15.79	16.32	15.68

Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
135	0 - 10%	0.072	7.9
7	10 - 20%	0.094	1.3
12	20 - 50%	0.304	1.8
0	50 - 100%	NA	NA
154	Total	0.11	4.6

Recoveries

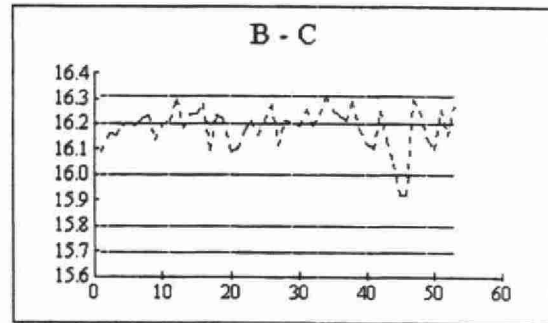
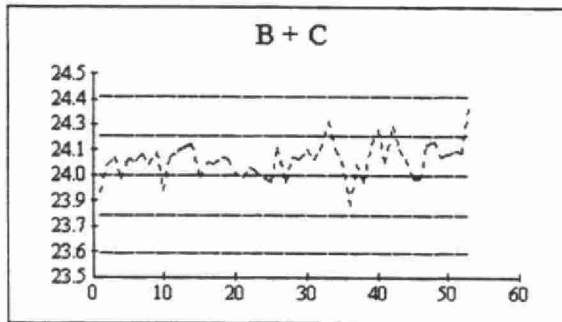
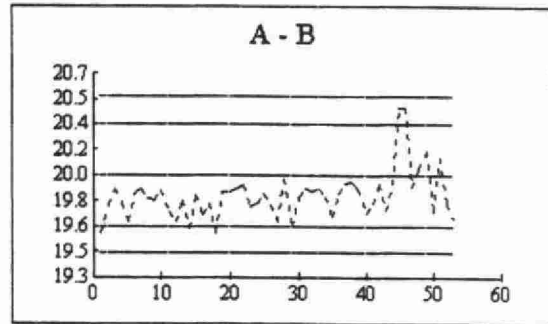
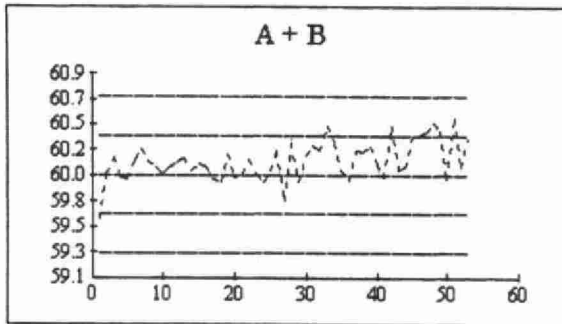
Number	Expected	Mean	Std. Dev.
53	35	34.958	0.528
53	21	21.065	0.297
53	7	6.962	0.103

Other Checks

	Number	Mean	Std. Dev.
LTB	53	-0.032	0.052
Digested Blank	53	-0.031	0.045

Nitrogen; total Kjeldahl (E3368A)

QC Data: 1/1/03 to 12/31/03



OXYGEN DEMAND, BIOCHEMICAL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '61
Method Reference No.	E3182	Reporting Unit	mg/L as O ₂
LIMS Product Code	BOD3182	Supervisor	P. Wilson
Sample Type/Matrix	Raw Sewage, Industrial Waste, Effluent, Drinking Water, Ground Water, Leachate, Surface Water		

SAMPLING:

Quantity Required:	400 mL
Container:	Glass or plastic

SAMPLE PREPARATION:

If necessary sample pH is adjusted to neutral and chlorine is removed by reaction with sodium sulphite.

ANALYTICAL PROCEDURE:

Oxygen depletion is measured as the difference in dissolved oxygen (DO) concentration. DO readings are taken prior to sample storage, and also at the end of storage in the dark at 20°C for five days (BOD₅). If necessary, dilutions are made with aerated, nutrient-enriched water to obtain a 25-75% oxygen depletion. If the sample has undergone any of the sample preparation steps listed above or if the sample is an industrial waste, a sewage seed is added. For such samples, calculation of an appropriate seed correction is required.

INSTRUMENTATION:

- YSI Model 59 DO meter (Yellow Springs Instrument Company) with DO probe equipped with stirrer and fitted with a Teflon membrane of 0.5 mil thickness which is permeable to oxygen (1 mil = 0.001 inch).
- Titration equipment for Winkler analysis of dissolved oxygen.
- Incubator (19-21°C); BOD bottles (300 mL)

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.2	Current T value: 1.0
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CALIBRATION (DO):

The standard is air-saturated reversed osmosis deionized water. The DO content is read from a table (ORBISPHERE LABORATORIES - Pressure temperature dissolved oxygen table) after measuring its temperature and the barometric pressure in the laboratory.

OXYGEN DEMAND, BIOCHEMICAL cont'd

CONTROLS:

Calibration (DO)	2 QC solutions of Pure-DW water which have been partially stripped of DO by flushing with nitrogen. These "solutions", of different but unknown DO, are compared using the oxygen meter and the Winkler titration procedure. The difference between the values for the two analytical methods is utilized as a slope control for the DO Analyzer.
Recovery (BOD5)*	3 Recovery standards prepared from a combination of Glucose and Glutamic Acid e.g. R1; the expected BOD5 is 67% of the oxygen requirement for complete oxidation.
Drift	Air saturated Pure-DW water after every 24 samples.
Blanks*	Pure-DW water and BOD dilution water

NOTES:

* These solutions are incubated for five days alongside samples.

OXYGEN DEMAND, BIOCHEMICAL (E3182)

QUALITY CONTROL DATA FROM 01/10/03 TO 12/24/03

Analytical Range: to 9.0 mg/L as O₂ at 20°C

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	100	0.00	-0.0445	-0.0445	0.0890
B:	100	0.00	-0.0198	-0.0198	0.0686

On any given day the calibration is accepted if the values obtained lie within the ranges:

-0.25 - 0.25

RECOVERIES:

Number of Data	Expected Depletion	Mean Depletion	Standard Deviation (1)
50	2.17	2.16	0.2963
50	4.34	4.13	0.2987
50	6.54	6.18	0.2761

DUPLICATES:

n Data Pairs	Sample Depletion Span	Standard Deviation (2)	Coefficient of variation(%)
89	0.0 - 1.8	0.1725	19.9
38	1.9 - 4.5	0.2796	9.7
19	4.6 - 9.0	0.4737	7.7
146	Overall	0.2602	

OTHER CHECKS:

	n	Mean	Standard Deviation (1)
5 Day Pure-DW Blank	5050	0.089	0.1238
5 Day BOD Blank		0.107	0.1095

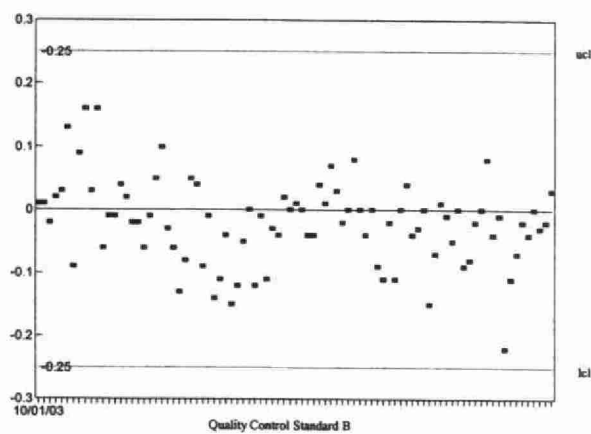
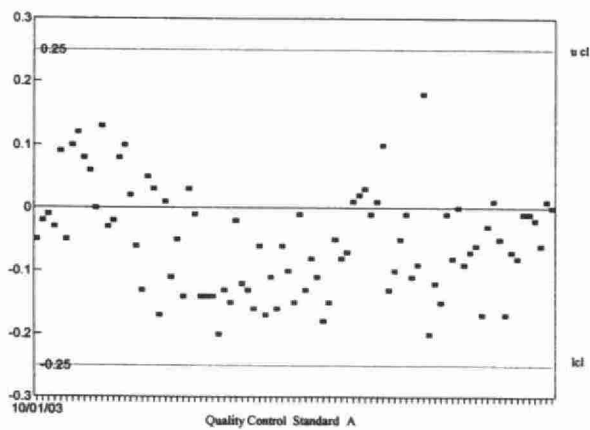
NOTES:

The final concentration of BOD in mg/L as O₂ is determined by the oxygen depletion after 5 days at 20°C multiplied by a dilution and seed correction factor.

OXYGEN DEMAND, BIOCHEMICAL (E3182)

QUALITY CONTROL DATA FROM 01/10/03 TO 12/24/03

Analytical Range: to 9.0 mg/L as O₂ at 20°C



OXYGEN DEMAND, CHEMICAL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/07/82
Method Reference No.	E3170	Reporting Unit	mg/L as O ₂
LIMS Product Code	COD3170	Supervisor	P. Wilson
Sample Type/Matrix	Drinking Water, Ground Water, Surface Water		

SAMPLING:

Quantity Required	25 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Samples (10.0 mL) are mixed with an acidified potassium dichromate solution which contains mercuric sulphate to suppress chloride interference. After adding concentrated sulphuric acid containing silver sulphate as a catalyst, the mixture is digested in a mechanical-convection oven for 3 hours at 149°C. Analysis is completed by automated colourimetric measurement of trivalent chromium. Approximate absorbance: 0.05 at the full scale level.

INSTRUMENTATION:

- Culture tubes with Teflon closures; mechanical-convection oven
- Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 600 nm.

REPORTING:

Maximum Significant Figures: 3	Current W value: 1	Current T value: 5
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CALIBRATION:

3 digested BL plus 3 digested standards

CONTROLS:

Calibration	2 digested standards, e.g. QCA
Drift	Undigested BL every 10 samples; standard plus BL at end of run
Recovery	2 digested standards, e.g. R1
Interference	Digested standard (40 mg/L as O ₂) spiked with 50 mg/L Cl confirms suppression of chloride interference.

NOTES:

In order to retard sample decomposition the first reagent (acidified dichromate) is added as soon as possible at the laboratory. Analysis is scheduled for completion within the week.

The recovery standard is a material known to be very difficult to digest. The expected recovery is approximately 85%, based on long term experience. We continue to use this material in spite of the poor recovery, because if the slightest problem exists with the digestion step, the recovery falls off sharply to approximately 10%.

Oxygen Demand Chemical (E3170)

Analytical Range : to 50.0 mg/L as O₂

CALIBRATION CONTROL:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	36	40	39.733	-0.267	1.022
B	36	10	9.564	-0.436	1.042
C	NA	NA	NA	NA	NA
A + B		50	49.297	-0.703	1.714
A - B		30	30.169	0.169	1.15
B + C	NA	NA	NA	NA	NA
B - C	NA	NA	NA	NA	NA

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	1.0319
	Within Runs	0.8132
	Between/Within	1.2689

s.d.(BC)	Between Runs	NA
	Within Runs	NA
	Between/Within	NA

CONTROL LIMITS:

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	52.299	47.701	54.598	45.402
A - B	32.299	27.701	33.449	26.551
B + C	NA	NA	NA	NA
B - C	NA	NA	NA	NA

DUPLICATES:

Number	Concentration	Std. Dev.	% Coeff of Var
89	0 - 10%	1.389	81.7
7	10 - 20%	1.248	15.9
21	20 - 50%	2.07	11.9
33	50 - 100%	6.113	20.9
	Total	3.302	

RECOVERIES:

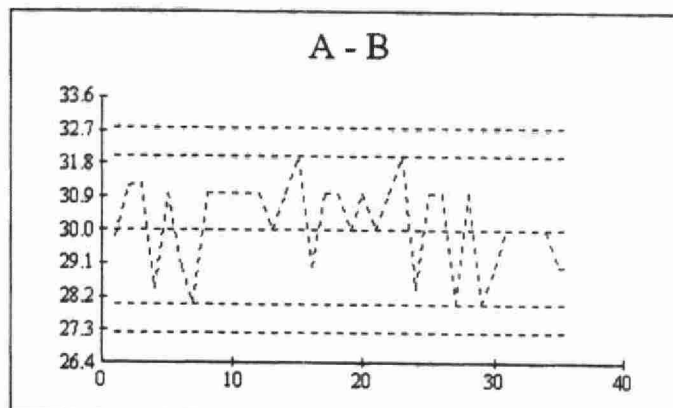
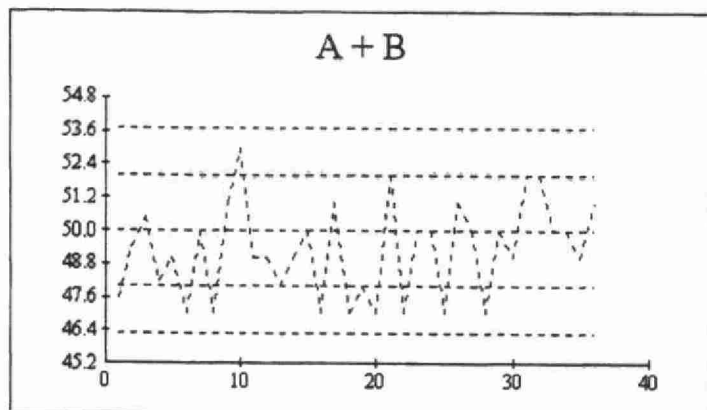
Number	Expected	Mean	Std. Dev.
32	40	36.253	2.29
30	10	9.707	1.615

OTHER CHECKS:

	Number	Mean	Std. Dev.
Digested Blank	2	36.4	1.98

Oxygen Demand Chemical (E3170)

QC Data: 1/1/03 to 12/31/03



OXYGEN DEMAND, CHEMICAL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/07/82
Method Reference No.	E3246	Reporting Unit	mg/L as O ₂
LIMS Product Code	COD3246	Supervisor	P. Wilson
Sample Type/Matrix	Raw Sewage, Industrial Waste, Ground Water, Leachate, Effluent, Sludge, Surface Water, Process Water		

SAMPLING:

Quantity Required	25 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Samples (10.0 mL) are mixed with an acidified potassium dichromate solution which contains mercuric sulphate to suppress chloride interference. After adding concentrated sulphuric acid containing silver sulphate as a catalyst, the mixture is digested in a mechanical-convection oven for 3 hours at 149°C. Analysis is completed by automated colourimetric measurement of trivalent chromium. Approximate absorbance: 0.6 at the full scale level.

INSTRUMENTATION:

-Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 600 nm.

REPORTING:

Maximum Significant Figures: 3	Current W value: 2	Current T value: 10
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CALIBRATION:

2 digested BL plus 4 digested standards

CONTROLS:

Calibration	2 digested standards, e.g. QCA
Drift	Undigested BL every 10 samples; standard plus BL at end of run
Recovery	2 digested standards, e.g. R1
Interference	Digested standard (50 mg/L as O ₂) spiked with 900 mg/L Cl confirms suppression of chloride interference.

NOTES:

In order to retard sample decomposition the first reagent (acidified dichromate) is added as soon as possible at the laboratory. Analysis is scheduled for completion within the week.

The recovery standard is a material known to be very difficult to digest. The expected recovery is approximately 85%, based on long term experience. We continue to use this material in spite of the poor recovery, because if the slightest problem exists with the digestion step, the recovery falls off sharply to approximately 10%.

Oxygen Demand Chemical (E3246)

Analytical Range : to 400.0 mg/L as O₂

CALIBRATION CONTROL:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	11	400	401.455	1.455	5.128
B	11	100	97.818	2.182	5.93
A + B		500	499.273	0.727	7.799
A - B		300	303.636	3.636	7.877

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	5.5424
	Within Runs	5.5699
	Between/Within	0.9951

CONTROL LIMITS:

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	515.755	484.245	531.51	468.49
A - B	315.755	284.245	323.632	276.368

DUPLICATES:

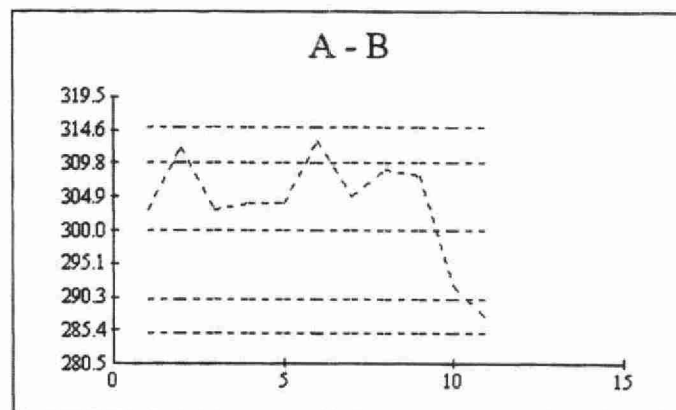
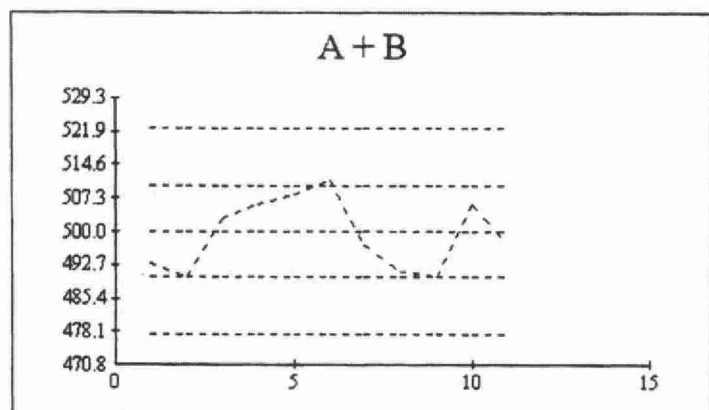
Number	Concentration	Std. Dev.	% Coeff of Var
13	0 - 10%	2.609	18.3
4	10 - 20%	4.249	7.3
3	20 - 50%	5.21	5.6
1	50 - 100%	12.021	6
21	Total	4.291	

RECOVERIES:

Number	Expected	Mean	Std. Dev.
11	400	383.636	15.473
11	100	101.455	12.129

Oxygen Demand Chemical (E3246)

QC Data: 1/1/03 to 12/31/03



pH

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	09/07/80
Method Reference No	E3218	Reporting Units	Dimensionless
LIMS Product Code	PHALCO3218, CONDPH3218	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Effluent, Industrial Waste, Raw Sewage, Drinking Water, Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or Plastic

ANALYTICAL PROCEDURE:

pH is directly measured on a stirred sample (20.0 mL) at room temperature. Stirring rate, tube size, degree of electrode immersion, and room temperature range are uniform for all samples and standards. Total fixed endpoint alkalinity, and conductivity are determined simultaneously.

INSTRUMENTATION:

Automated modular titration system with microcomputer control and data processing software.

REPORTING:

Maximum Significant Figures: 3

CALIBRATION:

2 standard buffers covering the pH range of 4 to 9

CONTROLS:

Calibration	2 QC standards e.g. QCA
Drift	In run standards throughout the run (diluted tap water 50% V/V)

pH (E3218)

QUALITY CONTROL DATA FROM 01/08/03 TO 12/29/03

Analytical Range: to 14.00 Dimensionless

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	110	7.41	7.42	0.01	0.0152
B:	110	4.45	4.42	-0.03	0.0413
A+B:		11.86	11.84	-0.02	0.0359
A-B:		2.96	3.00	0.04	0.0508

s.d.(AB) S(between runs): 0.031 Sw(within run): 0.036 S/Sw: 0.9

On any given day the calibration is accepted if the values obtained lie within the ranges:

11.64 - 12.08 for A+B
2.79 - 3.13 for A-B

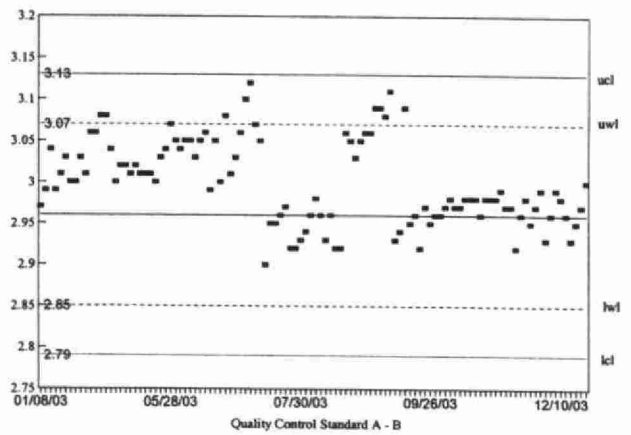
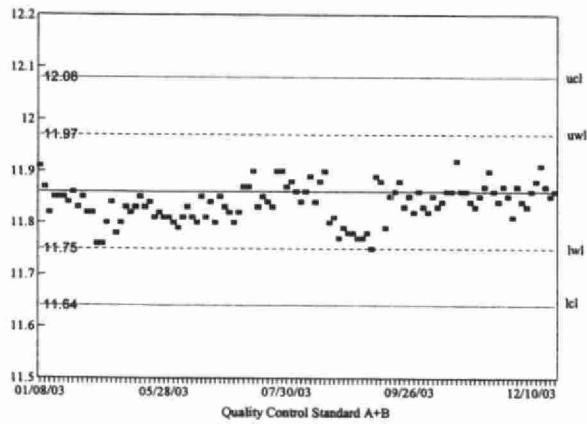
DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
31	1.00 - 7.00	0.0290	0.5
109	7.01 - 8.00	0.0403	0.5
179	8.01 - 12.00	0.0685	0.8
319	Overall	0.0572	

pH (E3218)

QUALITY CONTROL DATA FROM 01/08/03 TO 12/29/03

Analytical Range: to 14.00 Dimensionless



PHENOLICS, REACTIVE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/74
Method Reference No.	E3179	Reporting Unit	µg/L as Phenol
LIMS Product Code	PHEN3179	Supervisor	P.Wilson
Sample Type/Matrix	Ground Water, Surface Water, Effluent, Drinking Water, Leachate, Raw Sewage, Industrial Waste, Process Water, Precipitation		

SAMPLING:

Quantity Required	250 mL
Container	Glass, (Phenol bottle with white cap containing preservative is available)
Preservative	Sulfuric acid to pH 1.5 - 2

ANALYTICAL PROCEDURE:

Samples are automatically distilled from an acid media, and reactive phenolics in the distillate are determined colourimetrically by formation of an antipyrene dye through reactions with 4-aminoantipyrene and potassium ferricyanide.

Approximate absorbance: 0.03 at the full scale level.

INSTRUMENTATION:

Basic automated modular continuous flow system plus a distillation module. Colourimetric measurement is through a 5.0 cm. light path at 505 nm. Data capture and processing via a Labtronics System.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.2	Current T value: 1.0
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CALIBRATION:

BL plus 2 standards

CONTROLS:

Calibration	LTBL plus 2 standards, e.g. QCA (see note)
Drift	BL ,standard ,BL every 10 samples

NOTES:

An additional Quality Control Standard (QCC) was added to the method in March 1997.
The HP data capture / processing system was replaced by Labtronics in August 2002.

Phenolics; 4-AAP (E3179)

Analytical Range : to 50.0 ug/L as Phenol

CALIBRATION CONTROL:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	39	40	40.0249	0.0249	0.4903
B	39	10	10.1718	0.1718	0.2077
C	39	5	5.1513	0.1513	0.162
A + B		50	50.1967	0.1967	0.5781
A - B		30	29.8531	-0.1469	0.4825
B + C		15	15.3231	0.3231	0.2915
B - C		5	5.0205	0.0205	0.2319

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.3765
	Within Runs	0.3412
	Between/Within	1.1035

s.d.(BC)	Between Runs	0.1863
	Within Runs	0.164
	Between/Within	1.136

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	50.965	49.035	51.93	48.07
A - B	30.965	29.035	31.448	28.552
B + C	15.464	14.536	15.928	14.072
B - C	5.464	4.536	5.696	4.304

Duplicates

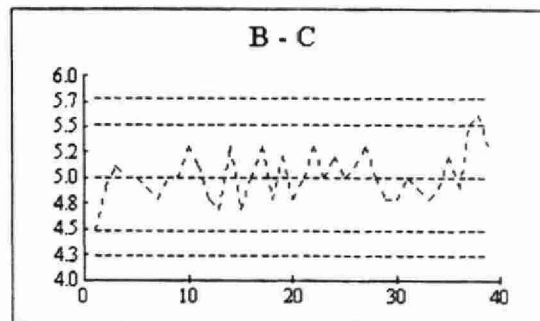
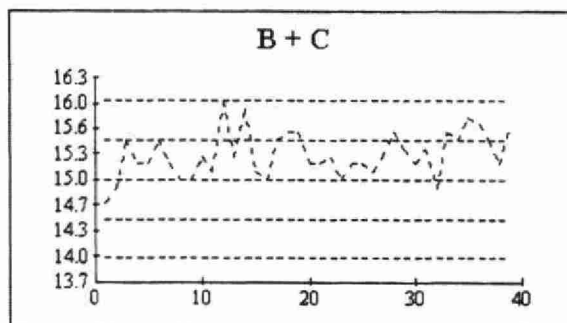
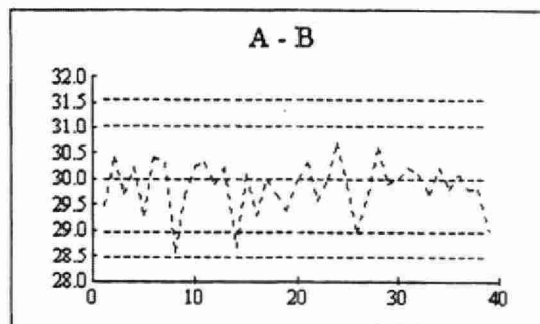
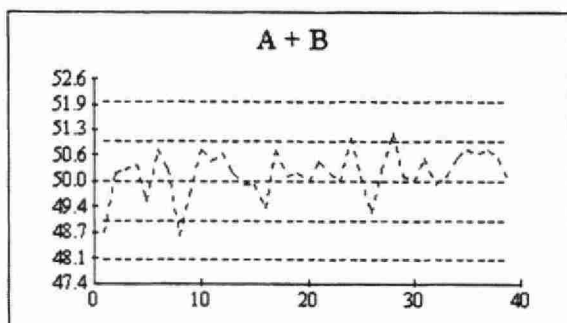
Number	Concentration	Std. Dev.	% Coeff of Var
76	0 - 10%	0.166	49.8
5	10 - 20%	0.277	3.5
3	20 - 50%	0.2	1
1	50 - 100%	0.141	0.3
85	Total	0.175	8.8

Other Checks	Number	Mean	Std. Dev.
LTB	39	0.0282	0.2102

Phenolics: 4-AAP

{ E3179 }

QC Data: 1/1/03 to 12/31/03



PHOSPHOROUS, REACTIVE ortho-PHOSPHATE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No.	E3364	Reporting Unit	mg/L as P
LIMS Product Code	DISNUT3364	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Ortho-phosphate is determined on the supernatant of a settled sample by formation of the reduced phospho-antimonyl-molybdate complex using ascorbic acid as the reducing agent.

Approximate absorbance: 0.2 at the full scale level.

Ammonia plus ammonium, nitrite, and nitrate plus nitrite are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 880 nm using IR sensitive phototube.

Data capture and processing via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.0005	Current T value: 0.0025
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL ,standard and BL after every 10 samples

NOTES:

The HP data capture / processing system was replaced by Labtronics in August 1999.

Phosphorus; phosphate (E3364)

Analytical Range : to 0.100 mg/L as P

CALIBRATION CONTROL:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	111	0.08	0.0795	0.0005	0.0008
B	111	0.04	0.0405	0.0005	0.0007
C	111	0.008	0.0081	0.0001	0.0005
A + B		0.12	0.12	0	0.0011
A - B		0.04	0.039	-0.001	0.001
B + C		0.048	0.0486	0.0006	0.0011
B - C		0.032	0.0324	0.0004	0.0006

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0007
	Within Runs	0.0007
	Between/Within	1

s.d.(BC)	Between Runs	0.0006
	Within Runs	0.0004
	Between/Within	1.5

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	0.1224	0.1176	0.1248	0.1152
A - B	0.0424	0.0376	0.0436	0.0364
B + C	0.0496	0.0464	0.0512	0.0448
B - C	0.0332	0.0302	0.0344	0.0296

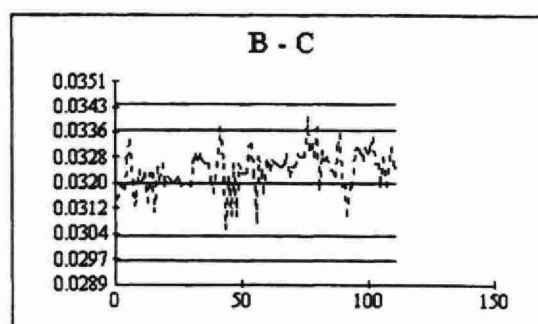
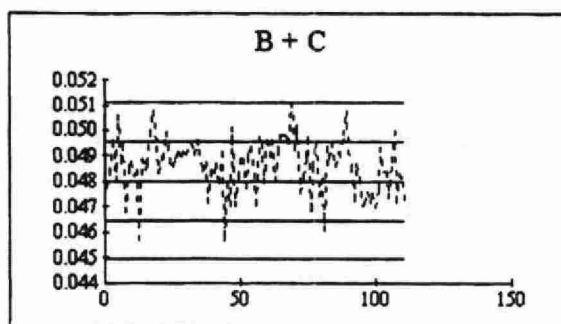
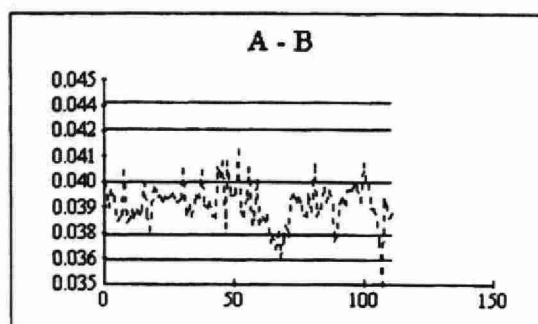
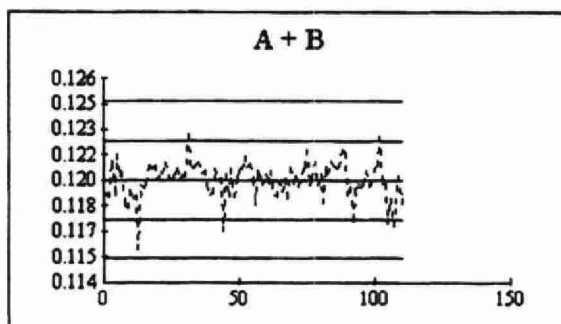
Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
224	0 - 10%	0.0005	19.4
39	10 - 20%	0.001	7.2
23	20 - 50%	0.001	3.2
12	50 - 100%	0.011	16.8
298	Total	0.002	22.7

Other Checks	Number	Mean	Std. Dev.
LTB	109	0.0004	0.0005

Phosphorus; phosphate [E3364A]

QC Data; 1/1/03 to 12/31/03



PHOSPHORUS, REACTIVE ortho-PHOSPHATE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No	E3366	Reporting Unit	mg/L as P
LIMS Product Code	DISNUT3366	Supervisor	P.Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Leachate, Ground Water.		

SAMPLING:

Quantity Required	10 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Ortho-phosphate is determined on the supernatant of a settled sample by formation of the reduced phospho-antimonyl-molybdate complex using ascorbic acid as the reducing agent.

Approximate absorbance: 0.5 at the full scale level.

Ammonia plus ammonium, nitrite, and nitrate plus nitrite are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 880 nm using IR sensitive phototube.

Data capture and processing via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.02	Current T value: 0.10
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL ,standard and BL every 10 samples

NOTES:

The HP capture / processing system was replaced by Labtronics in October 1999.

Phosphorus; phosphate (E3366)

Analytical Range : to 10.0 mg/L as P

CALIBRATION CONTROL:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	59	8	7.9886	-0.0114	0.0383
B	59	4	4.0097	0.0097	0.0275
C	59	0.8	0.8078	0.0078	0.0151
A + B		12	11.9983	-0.0017	0.048
A - B		4	3.979	-0.021	0.0463
B + C		4.8	4.8175	0.0175	0.0366
B - C		3.2	3.2019	0.0019	0.0252

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0334
	Within Runs	0.0327
	Between/Within	1.0214

s.d.(BC)	Between Runs	0.0222
	Within Runs	0.0178
	Between/Within	1.2472

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	12.14	11.86	12.29	11.71
A - B	4.14	3.86	4.22	3.78
B + C	4.87	4.73	4.94	4.66
B - C	3.27	3.13	3.31	3.09

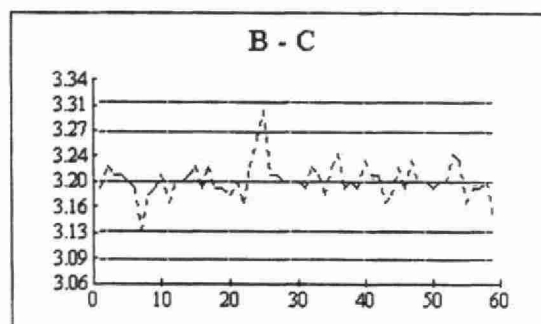
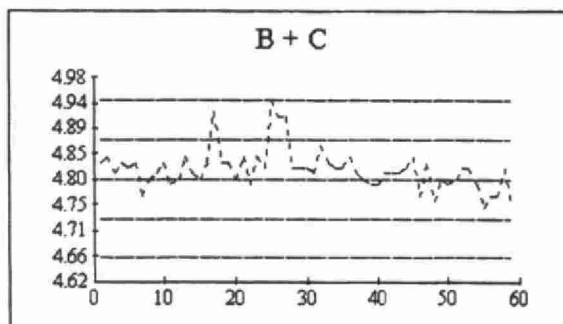
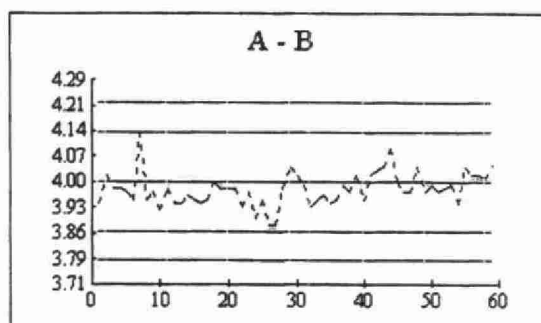
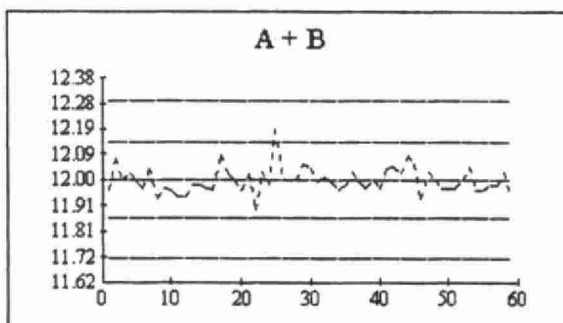
Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
114	0 - 10%	0.022	18.5
4	10 - 20%	0.018	1.2
2	20 - 50%	0.124	5.4
1	50 - 100%	0	0
121	Total	0.027	10.8

Other Checks	Number	Mean	Std. Dev.
LTB	59	-0.012	0.008

Phosphorus; phosphate [E3366A]

QC Data: 1/1/03 to 12/31/03



PHOSPHORUS, TOTAL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Mar '89
Method Reference No.	E3116	Reporting Unit	mg/g as P
LIMS Product Code	TNP3116	Supervisor	P. Wilson
Sample Type/Matrix	Soil, Sediment, Dried Sludge		

SAMPLING:

Quantity Required	0.08 to 0.4 g
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Phosphorus compounds are converted to simple inorganic forms by dissolution of the samples in hot sulphuric acid and potassium persulphate. Potassium persulphate is added later in the digestion to raise the boiling point and to provide a highly oxidizing environment to decompose the more resistant organic matter. The digestate is filtered and the filtrate is analyzed using an automated colourimetric system.

INSTRUMENTATION:

Hot plate

Basic automated modular continuous flow system : Colourimetric measurement is through a 5 cm. light path at 660 nm.

Data capture and processing via a computer system

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.02	Current T value: 0.10
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CALIBRATION:

3 High and 2 Low Calibration Standards

CONTROLS:

Calibration	In house composite B-Soil/sediment, QC Soils/Sediment (RS92), QCA, QCB and QCC
Drift	4 BL's per run; high and low calibration standard at the end of the run
Recovery	1 digested BL plus 4 digested standards

NOTES:

System is calibrated with undigested standards. QCA, QCB and QCC were introduced (April 2003).

PHOSPHORUS, TOTAL (E3116)

QUALITY CONTROL DATA FROM 01/18/01 TO 12/16/03

Analytical Range: to 2 mg/L as P

QUALITY CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	20	1.6	1.61	0.01	0.0089
B:	20	0.8	0.81	0.01	0.0060
C:	20	0.2	0.20	0.00	0.0065
A+B:		2.4	2.41	0.01	0.0118
A-B:		0.8	0.80	0.00	0.0094
B+C:		1.0	1.01	0.01	0.0099
B-C:		0.6	0.60	0.00	0.0076

s.d.(AB) S(between runs): 0.008

Sw(within run): 0.007

S/Sw: 1.13

s.d.(BC) S(between runs): 0.006

Sw(within run): 0.005

S/Sw: 1.16

The calibration is accepted if the calibration control values obtained lie within the ranges:

2.366	-	2.434	for	A+B
0.774	-	0.826	for	A-B
0.98	-	1.02	for	B+C
0.585	-	0.615	for	B-C

	n	Expected Concentration (mg/g)	Mean Concentration	Mean Bias	Standard Deviation (1)
RS92 In House Soil Composite	130	0.47	0.471	0.001	0.0347
RSM-2781 - Domestic Sludge (non certified)	130	24.0	24.288	0.288	1.3048

Note: RS92 and RSM2781 contain two sets of data for each year (2001 - 2003)

The run is accepted if the control values obtained lie within the ranges:

0.4	-	0.54	for	RS92
17.9	-	30.1	for	RSM-2781

Recovery Standards

	n	Expected Concentration (mg/L)	Mean Concentration	Standard Deviation (1)
R1	85	1.05	1.066	0.0242
R2	45	0.35	0.368	0.0223

Note: R1 contains a single set of data for 2001 & 2002; two sets of data for 2003

R2 contains a single set of data for 2001 and 2002 only.

QCA, QCB and QCC contain data for 2003 only.

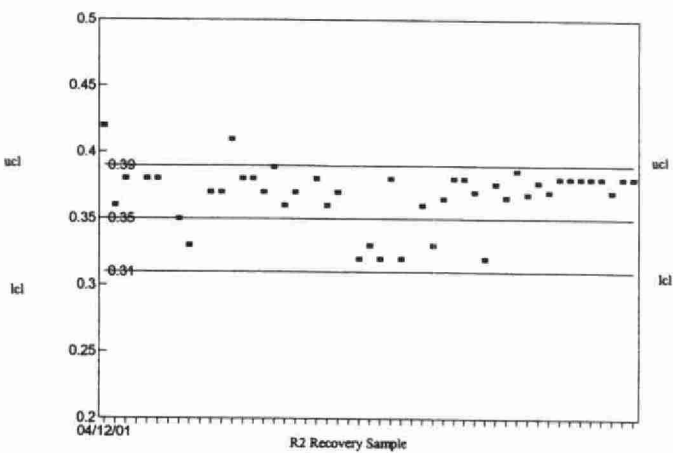
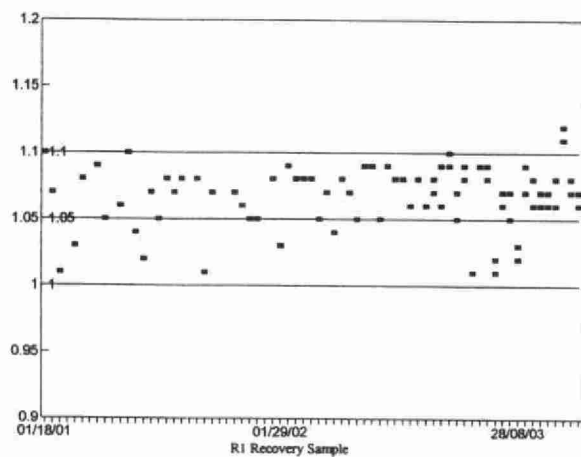
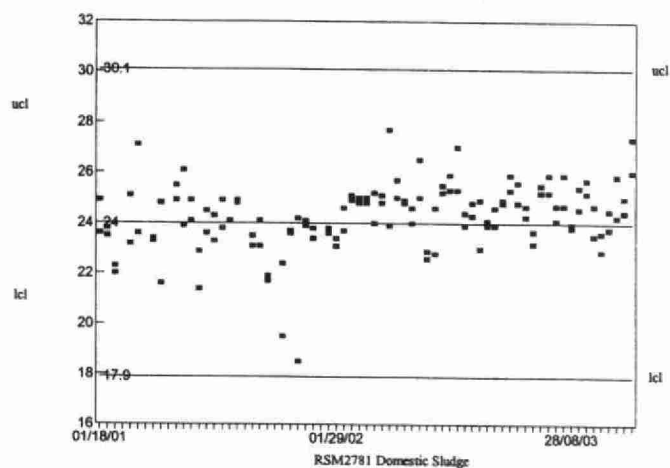
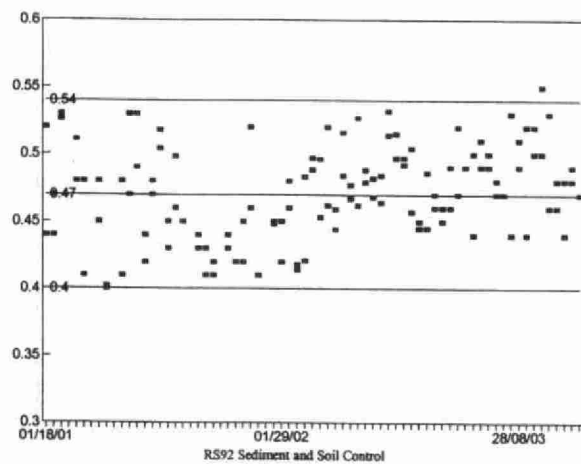
DUPLICATES: (Sediment/Soils)

n Data Pairs	Sample Concentration Span (mg/g)	Standard Deviation (2)	Coefficient of variation(%)
38	0.00 - 0.50	0.0307	8.9
91	0.51 - 1.00	0.0529	7.1
37	1.00 - 2.50	0.0618	4.4
19	2.51 - 5.00	0.1236	3.6
185	Overall	0.0625	

PHOSPHORUS, TOTAL (E3116)

QUALITY CONTROL DATA FROM 01/18/01 TO 12/16/03

Analytical Range: to 2 mg/g as P

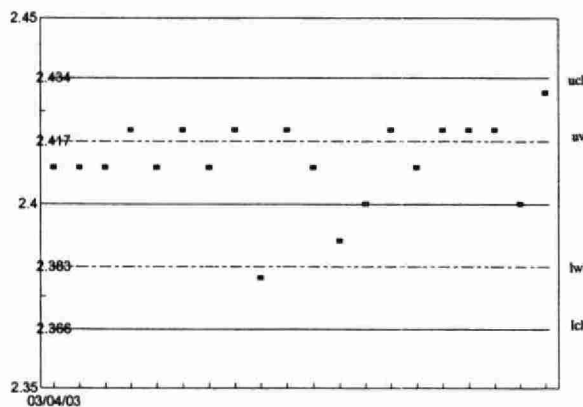


Note: For explanation of any exceedence, refer to raw data file.

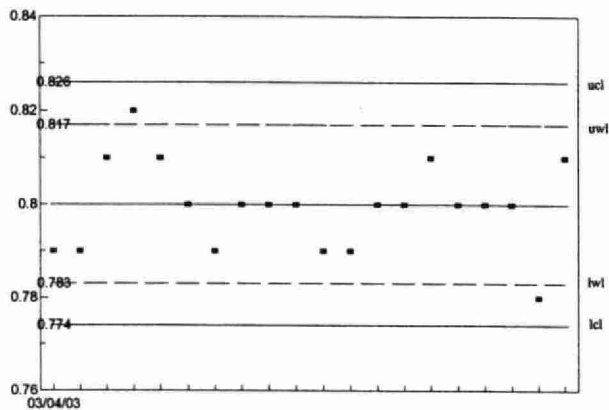
PHOSPHORUS, TOTAL (E3116)

QUALITY CONTROL DATA FROM 04/03/03 TO 12/16/03

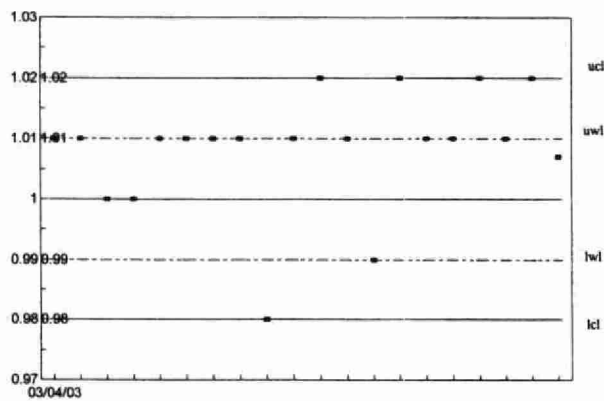
Analytical Range: to 2mg/L as P



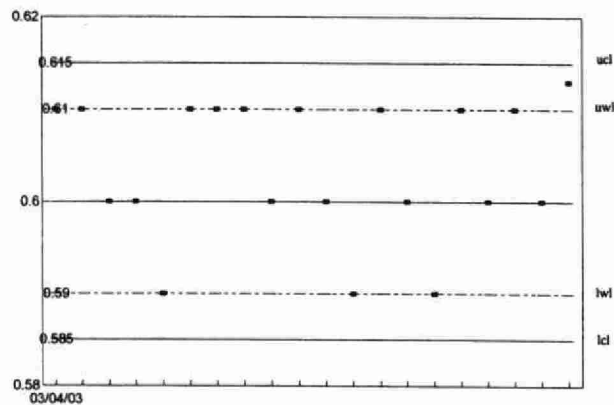
Quality Control Standard A+B



Quality Control Standard A-B



Quality Control Standard B+C



Quality Control Standard B-C

PHOSPHORUS, TOTAL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Mar '89
Method Reference No.	E3118	Reporting Unit	mg/g as P
LIMS Product Code	TNP3118	Supervisor	P. WILSON
Sample Type/Matrix	Vegetation, Moss Bag		

SAMPLING:

Quantity Required	0.02 to 0.04 g
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Phosphorus compounds are converted to simple inorganic forms by dissolution of the samples in hot sulphuric acid and potassium persulphate. Potassium persulphate is added later in the digestion to raise the boiling point and to provide a highly oxidizing environment to decompose the more resistant organic matter. The digestate is analyzed using an automated colourimetric system.

INSTRUMENTATION:

Hot plate.

Basic automated modular continuous flow system : Colourimetric measurement is through a 5 cm. light path at 660 nm.

Data capture and processing via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.02	Current T value: 0.10
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CALIBRATION:

3 High and 2 Low Calibration Standards

CONTROLS:

Calibration	QC VEG (Pine Needles), QCA, QCB and QCC
Drift	4 BL's per run; high and low calibration standard at the end of the run
Recovery	3 digested BL plus 2 digested standards R1 & R2

NOTES:

System is calibrated with undigested standards.

QCA, QCB and QCC were introduced in April 2003.

PHOSPHORUS, TOTAL (E3118)

QUALITY CONTROL DATA FROM 01/18/01 TO 12/15/03

Analytical Range: to 2 mg/L as P

QUALITY CONTROL:

From 01/09/03 to 12/15/03

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	5	1.6	1.60	0.00	0.0100
B:	5	0.8	0.81	0.01	0.0045
C:	5	0.2	0.20	0.00	0.0055
A+B:		2.4	2.41	0.01	0.0110
A-B:		0.8	0.79	-0.01	0.0110
B+C:		1.0	1.01	0.01	0.0084
B-C:		0.6	0.60	0.00	0.0054

s.d.(AB) S(between runs): 0.008

s.d.(BC) S(between runs): 0.005

Sw(within run): 0.008

Sw(within run): 0.004

S/Sw: 1.00

S/Sw: 1.29

The calibration is accepted if the calibration control values obtained lie within the ranges:

2.366 - 2.434 for A+B

0.774 - 0.826 for A-B

0.98 - 1.02 for B+C

0.585 - 0.615 for B-C

CALIBRATION CONTROL:

	n	Expected Concentration (mg/g)	Mean Concentration	Mean Bias	Standard Deviation (1)
Pine Needles	36	1.2	1.117	-0.083	0.0537

The calibration is accepted if the calibration control values obtained lie within the ranges:

1.1 - 1.3 for pine needles

Recovery Standards

	n	Expected Concentration (mg/L)	Mean Concentration	Standard Deviation (1)
R1	4242	1.05	1.063	0.0216
R2		0.35	0.364	0.0231

Note: Pine Needles contain a single set of data for 2001 & 2002; two sets of data for 2003
R1 & R2 contain a single set of data for 2001 to 2003

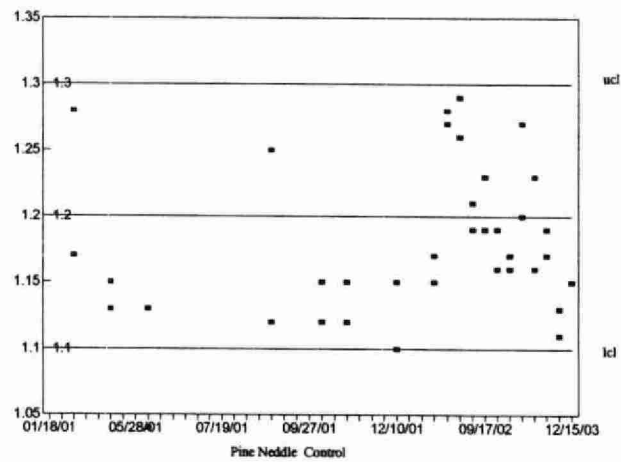
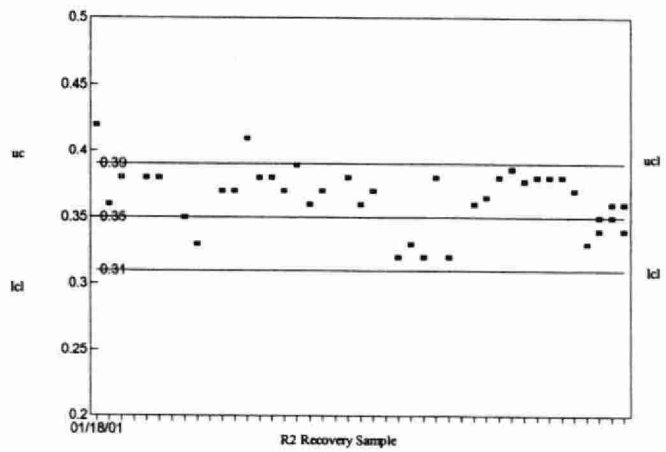
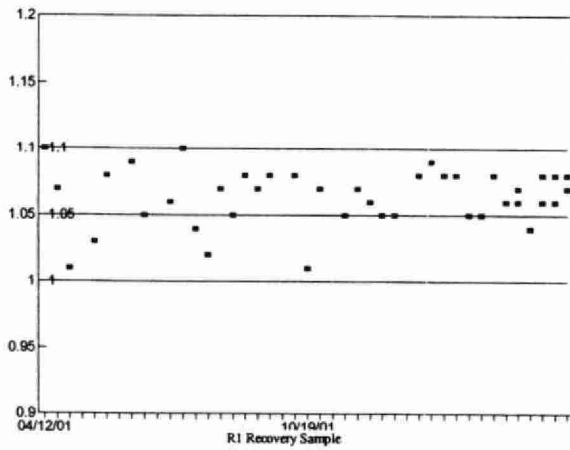
DUPLICATES: (VEGETATION)

n Data Pairs	Sample Concentration Span (mg/g)	Standard Deviation (2)	Coefficient of variation(%)
3	0.00 - 0.50	0.0491	12.1
14	0.51 - 2.50	0.0806	4.3
29	2.51 - 5.00	0.1444	3.9
46	Overall	0.1236	

PHOSPHORUS, TOTAL (E3118)

QUALITY CONTROL DATA FROM 01/08/01 TO 12/15/03

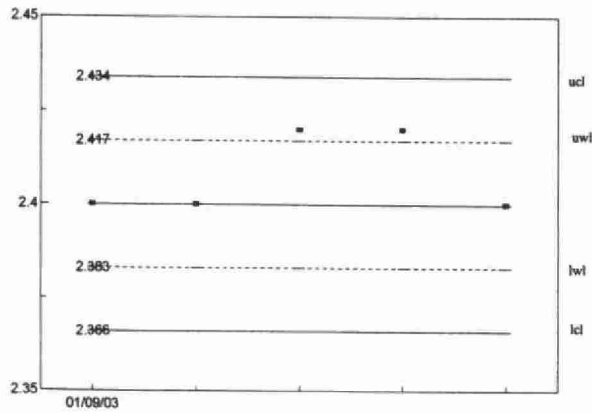
Analytical Range: to 2 mg/L as P



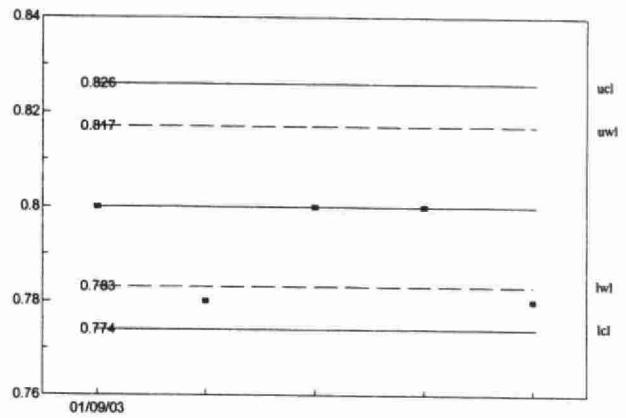
PHOSPHORUS, TOTAL (E3118)

QUALITY CONTROL DATA FROM 04/03/03 TO 12/16/03

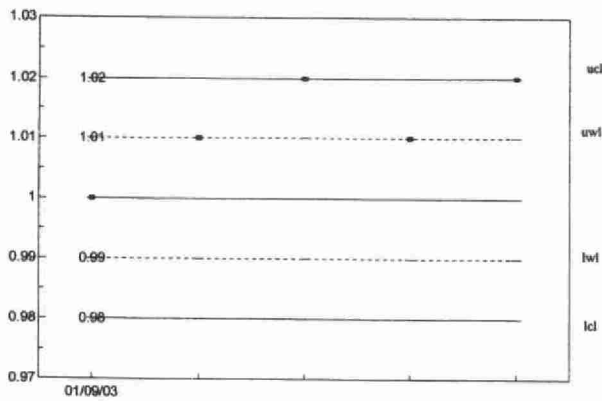
Analytical Range: to 2mg/L as P



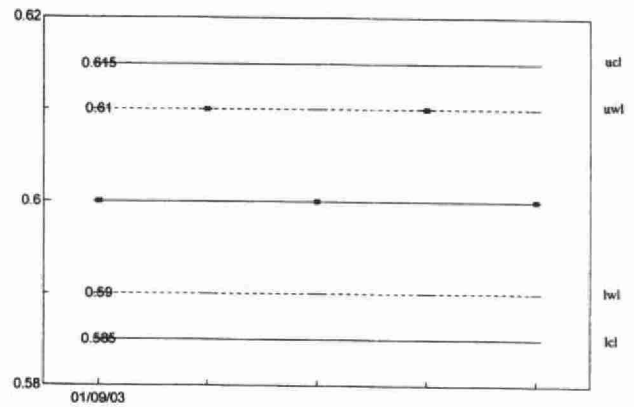
Quality Control Standard A+B



Quality Control Standard A - B



Quality Control Standard B+C



Quality Control Standard B - C

PHOSPHORUS, TOTAL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No	E3367	Reporting Unit	mg/L as P
LIMS Product Code	TOTNUT3367	Supervisor	P.Wilson
Sample Type/Matrix	Precipitation, Drinking Water, Surface Water		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Samples are digested in a sulphuric acid-mercuric oxide-potassium sulphate media using three block digesters kept at 180°C, 210°C and 360°C. The pH of the digestate is adjusted in-line and then orthophosphate is determined by formation of the reduced phospho-antimonyl-molybdate complex using ascorbic acid as the reducing agent.

Approximate absorbance: 0.4 at the full scale level.

Total Kjeldahl nitrogen is determined simultaneously.

INSTRUMENTATION:

Three Block digesters

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 880 nm using appropriate phototube.

Data capture and processing via a computer system

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.002	Current T value: 0.010
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CALIBRATION:

BL plus 7 undigested standards

CONTROLS:

Calibration	LTBL plus 3 undigested standards, e.g. QCA
Drift	BL , undigested standard , BL every 10 samples
Recovery	3 digested BL plus 3 digested standards in duplicate, e.g. R1

NOTE:

The HP capture / processing system was replaced by Labtronics in May 1999.

Phosphorus; total (E3367)

Analytical Range : to 0.200 mg/L as P

CALIBRATION CONTROL:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	93	0.16	0.159	-0.001	0.001
B	93	0.08	0.0801	0.0001	0.001
C	93	0.016	0.0158	-0.0002	0.002
A + B		0.24	0.239	-0.001	0.002
A - B		0.08	0.079	-0.001	0.001
B + C		0.096	0.09596	-0.00004	0.001
B - C		0.064	0.0643	0.0003	0.001

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0012
	Within Runs	0.0007
	Between/Within	1.7143

s.d.(BC)	Between Runs	0.0007
	Within Runs	0.0007
	Between/Within	1

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	0.2434	0.2366	0.2468	0.2332
A - B	0.0834	0.0766	0.0851	0.049
B + C	0.098	0.094	0.1	0.092
B - C	0.066	0.062	0.067	0.061

Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
193	0 - 10%	0.002	24.6
44	10 - 20%	0.004	14.3
23	20 - 50%	0.002	3.6
4	50 - 100%	0.005	3.5
264	Total	0.002	11.3

Recoveries

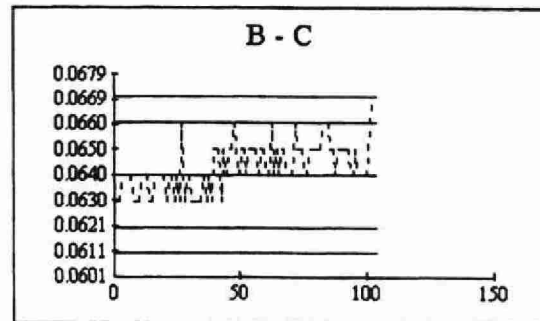
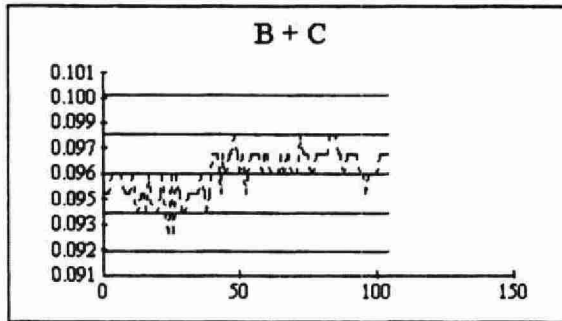
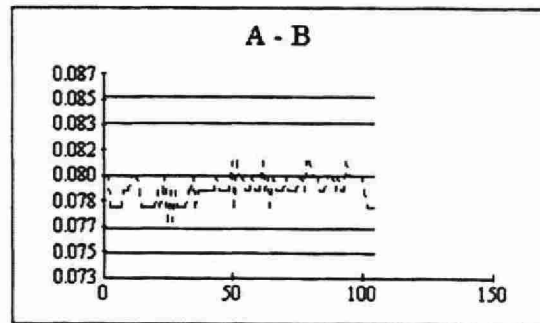
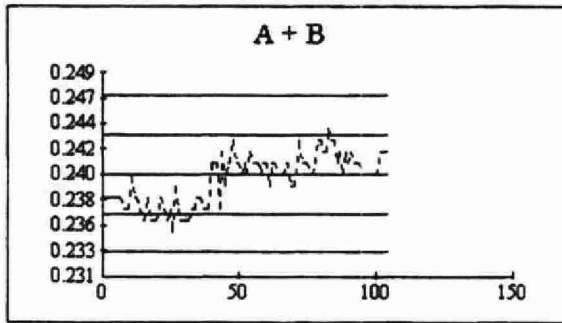
Number	Expected	Mean	Std. Dev.
	0.14	0.138	0.002
92	0.084	0.083	0.002
92	0.028	0.028	0.001

Other Checks

	Number	Mean	Std. Dev.
LTB	93	0	0.0003
Digested Blank	93	0.001	0.001

Phosphorus: total [E3367A]

QC Data: 1/1/03 to 12/31/03



PHOSPHORUS, TOTAL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/04/79
Method Reference No.	E3368	Reporting Unit	mg/L as P
LIMS Product Code	TOTNUT3368	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Raw Sewage, Industrial Waste, Effluent, Ground Water, Process Water, Leachate.		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Samples are digested in a sulphuric acid-mercuric oxide-potassium sulphate media using three block digestors kept at 180°C, 210°C and 360°C. The pH of the digestate is adjusted in-line and then orthophosphate is determined by formation of the reduced phospho-antimonyl-molybdate complex using ascorbic acid as the reducing agent.

Approximate absorbance: 0.8 at the full scale level.

Total Kjeldahl Nitrogen is determined simultaneously.

INSTRUMENTATION:

3-Block digesters

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 880 nm using an IR sensitive phototube. Data capture and processing via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.02	Current T value: 0.10
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	BL every 10 samples; undigested standard every 20 samples
Recovery	3 digested BL plus 3 digested standards in duplicate, e.g. R1

NOTES:

System is calibrated with undigested standards.

The HP capture / processing system was replaced by Labtronics in April 1999

Phosphorus; total (E3368)

Analytical Range : to 10.0 mg/L as P

CALIBRATION CONTROL:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	54	8	8.0002	0.0002	0.027
B	54	4	4.004	0.004	0.018
C	54	0.8	0.8004	0.0004	0.015
A + B		12	12.004	0.004	0.033
A - B		4	3.996	-0.004	0.031
B + C		4.8	4.804	0.004	0.023
B - C		3.2	3.204	0.004	0.023

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0227
	Within Runs	0.0219
	Between/Within	1.0365

s.d.(BC)	Between Runs	0.0162
	Within Runs	0.0163
	Between/Within	0.9939

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	12.065	11.935	12.13	11.87
A - B	4.065	3.935	4.097	3.903
B + C	4.834	4.766	4.868	4.732
B - C	3.234	3.166	3.251	3.149

Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
149	0 - 10%	0.018	11.1
3	10 - 20%	0.066	4.2
1	20 - 50%	0.007	0.3
0	50 - 100%	NA	NA
153	Total	0.02	9.7

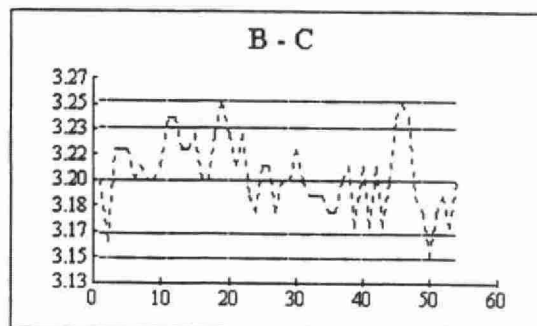
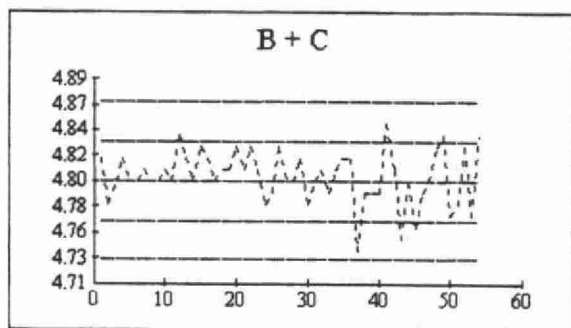
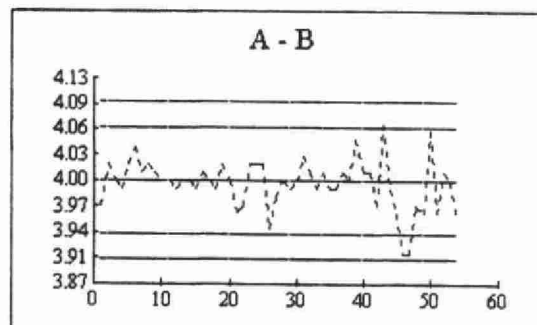
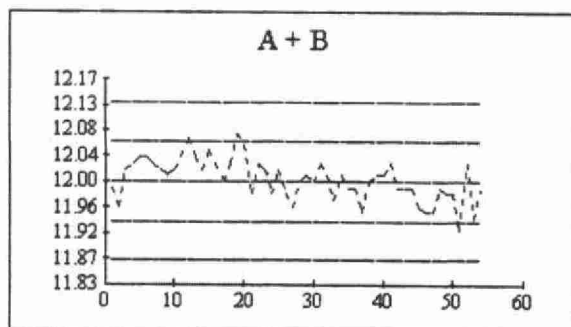
Recoveries

Number	Expected	Mean	Std. Dev.
54	7	6.903	0.09
54	4.2	4.155	0.051
54	1.4	1.392	0.026

Other Checks

	Number	Mean	Std. Dev.
LTB	54	0.003	0.016
Digested Blank	54	0.008	0.015

QC Data: 1/1/03 to 12/31/03



SILICON, REACTIVE SILICATES

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	01/02/75
Method Reference No.	E3370	Reporting Unit	mg/L as Si
LIMS Product Code	DCSI3370	Supervisor	P.Wilson
Sample Type/Matrix	Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water Ground Water, Leachates, Precipitation, Surface Water		

SAMPLING:

Quantity Required	10 mL
Container	Plastic

ANALYTICAL PROCEDURE:

Reactive silicates are determined by formation of a reduced molybdo-silicate complex at pH 1.6, using ascorbic acid as the reducing agent, and oxalic acid to suppress phosphate interference.

Approximate absorbance: 0.7 at the full scale level.

Dissolved inorganic and dissolved organic carbon are determined simultaneously.

INSTRUMENTATION:

Basic automated modular continuous flow system with colourimetric measurement through a 5.0 cm. light path at 660 nm. Data capture and processing via a computer system.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.02	Current T value: 0.10
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CALIBRATION:

BL plus 7 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g., QCA
Drift	BL, standard and BL every 10 samples.

NOTES:

December 1998: The HP data capture/processing system was replaced by Labtronics.

Silicon; reactive silicates (E3370)

Analytical Range : to10.0 mg/L as Si

CALIBRATION CONTROL:

	Number	Expected	Mean	Mean Bias	Std. Dev.
A	58	8	8.0119	0.0119	0.0522
B	58	2	2.0066	0.0066	0.0158
C	58	0.5	0.4838	-0.0162	0.0142
A + B		10	10.0184	0.0184	0.0583
A - B		6	6.0053	0.0053	0.0505
B + C		2.5	2.4903	-0.0097	0.0271
B - C		1.5	1.5228	0.0228	0.0131

Between Run VS Within Run Standard Deviations

s.d.(AB)	Between Runs	0.0386
	Within Runs	0.0357
	Between/Within	1.0812
s.d.(BC)	Between Runs	0.0151
	Within Runs	0.0093
	Between/Within	1.6237

Control Limits

Control Standard	Warning Limits		Control Limits	
	Upper	Lower	Upper	Lower
A + B	10.17	9.83	10.34	9.66
A - B	6.17	5.83	6.25	5.75
B + C	2.57	2.43	2.63	2.37
B - C	1.57	1.43	1.6	1.4

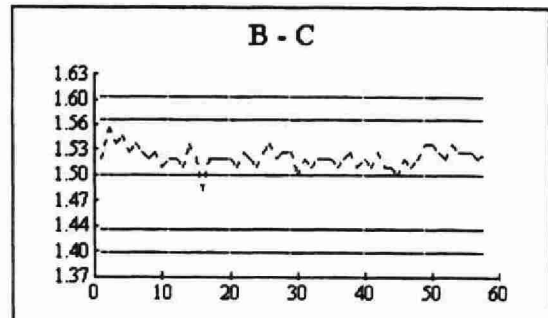
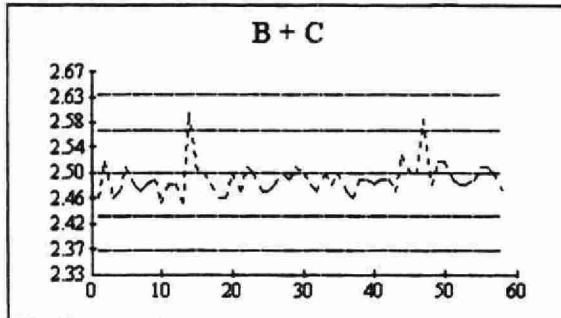
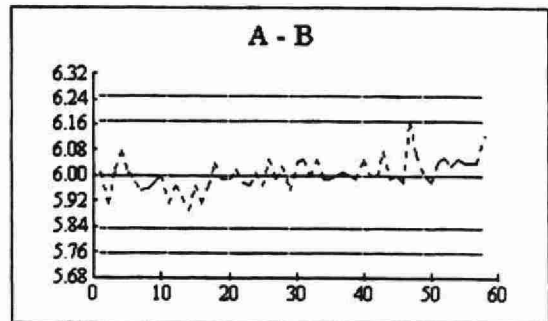
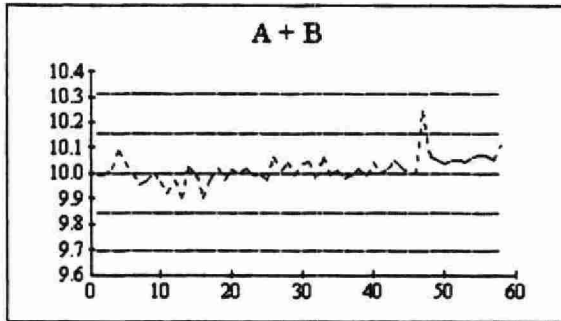
Duplicates

Number	Concentration	Std. Dev.	% Coeff of Var
81	0 - 10%	0.008	1.6
46	10 - 20%	0.013	0.9
37	20 - 50%	0.026	0.8
3	50 - 100%	0.026	0.4
167	Total	0.016	1.1

Other Checks	Number	Mean	Std. Dev.
LTB	58	-0.0248	0.0187

Silicon; reactive silicate (E3370A)

QC Data; 1/1/03 to 12/31/03



SOLIDS, DISSOLVED

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '61
Method Reference No.	E3188	Reporting Unit	mg/L
LIMS Product Code	TSD3188,DS3188,DIGN3188	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Surface Water, Drinking Water, Ground Water, Leachate		

SAMPLING:

Quantity Required	125 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Sample is filtered under moderate suction through a Whatman 934AH grade glass fibre filter. Generally 100 mL of filtrate (alternate 50 mL) is pipetted into a preweighed Teflon dish, dried at $103 \pm 2^{\circ}\text{C}$, and stored in a desiccator for at least 24 hours. The dissolved solids content is calculated by subtracting the original dish mass from the dried residue + dish mass. Data collection, calculations, and transfer of results to LIMS are controlled by a computer system.

INSTRUMENTATION:

Balance (5 decimal places), drying oven, suction filtration apparatus, dishes (Teflon).
Computer system with appropriate software.

REPORTING:

Maximum Significant Figures: 3	Current W value: 2	Current T value: 10
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CALIBRATION:

Balance zero
Balance internal calibration is performed daily.

CONTROLS:

Calibration	2 S class weights, e.g. QCA (results in grams)
Drift	Balance is reset to zero after every 10 weighings by the microcomputer.
Recovery	2 standards, e.g. R1
Method Blank	100 mL Pure Water.

SOLIDS, DISSOLVED (E3188)

QUALITY CONTROL DATA FROM 01/16/03 TO 12/31/03

CALIBRATION CONTROL:

	n	Expected Mass (g)	Mean Mass Measured (g)	Mean Bias (g)	Standard Deviation (1)
A:	68	50.00	50.0001	0.0001	0.00009
B:	68	30.00	30.0001	0.0001	0.00007
A+B:		80.00	80.0001	0.0001	0.00015
A-B:		20.00	20.0000	0.0000	0.00008

s.d.(AB) S(between runs): 0.00008 Sw(within run): 0.00005 S/Sw: 1.55

The calibration is accepted if the calibration control values (mean mass measured) obtained lie within the ranges expressed in grams:

79.9995 - 80.0009 for A+B
19.9994 - 20.0004 for A-B

RECOVERIES:

Number of Data	Expected Concentration (mg/L)	Mean Concentration Measured (mg/L)	Standard Deviation (1)
59	2000.0	1994.31	9.92
65	500.0	496.86	9.66

DUPLICATES:

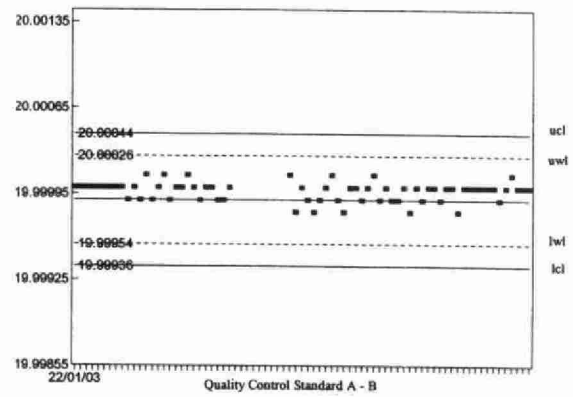
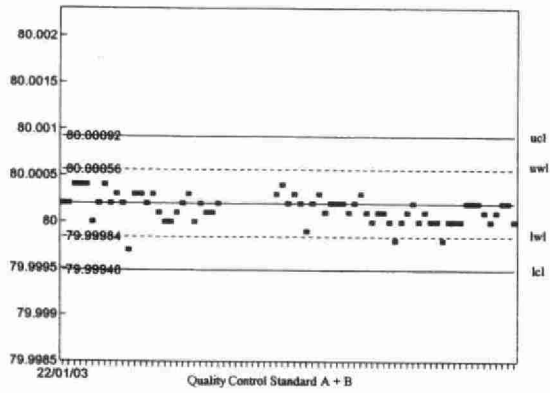
n Data Pairs	Sample Concentration Span (mg/L)	Standard Deviation (2)	Coefficient of variation(%)
10	0 - 500	9.2416	2.0
122	501 - 1000	14.3402	2.1
28	1001 - 5000	27.1013	1.6
160	Overall	17.0492	

OTHER CHECKS:

	n	Data Mean (mg/L)	Standard Deviation (1)
Blank	60	-1.1482	4.8435

DISSOLVED, SOLIDS (E3188)

QUALITY CONTROL DATA FROM 01/16/03 TO 12/31/03



SOLIDS, SUSPENDED

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '81
Method Reference No.	E3188	Reporting Unit	mg/L
LIMS Product Code	TSD3188, SS3188	Supervisor	P.Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Surface Water, Drinking Water, Ground Water, Leachate		

SAMPLING:

Quantity Required	5-500 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

An appropriately shaken sample volume (5 to 500 mL) is pipetted or quickly poured into a graduated cylinder, and the volume is measured. The aliquot is then filtered under moderate suction through a preweighed Whatman 934AH glass fibre filter. The graduated cylinder and then the filter are washed with a total of 50 mL distilled water. The filter is dried at 103-105°C, and suspended solids content is calculated by subtracting the original filter mass from the dried filter mass. Data collection, calculations, and transfer of results to LIMS are controlled by a computer system.

INSTRUMENTATION:

Balance (5-decimal places), drying oven, suction filtration apparatus.
Computer system with appropriate software.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.5	Current T value: 2.5
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CONTROLS:

Calibration	2 S class weights, e.g. QCA (results in grams)
Drift	Balance is reset to zero after every 10 weighings by the microcomputer.
Recovery	2 standards, e.g. R1
Method Blank	Filter washed with 500 mL distilled water

NOTES:

A standard correction factor (-0.00022g) was applied to all filters to account for weight loss during filtering. A new set of Q.C. weights was introduced for the year 2000, along with new limits for the weights.

SOLIDS, SUSPENDED (E3188)

QUALITY CONTROL DATA FROM 01/16/03 TO 12/31/03

CALIBRATION CONTROL:

	n	Expected Mass (g)	Mean Mass Measured (g)	Mean Bias (g)	Standard Deviation (1)
C:	302	0.50	0.50000	0.00000	0.00001
D:	302	0.05	0.05000	0.00000	0.00001
C+D:		0.55	0.55000	0.00000	0.00002
C-D:		0.45	0.45000	0.00000	0.00001

s.d.(CD) S(between runs): 0.00001 Sw(within run): 0.00001 S/Sw: 1.20

The calibration is accepted if the calibration control values (mean mass measured) obtained are within the ranges expressed in grams:

0.549948 - 0.55005 for C+D
0.449961 - 0.45004 for C-D

RECOVERIES:

Number of Data	Expected Concentration (mg/L)	Mean Concentration Measured (mg/L)	Standard Deviation (1)
300	200.0	195.82	2.3741
301	50.0	48.82	0.9751

DUPLICATES:

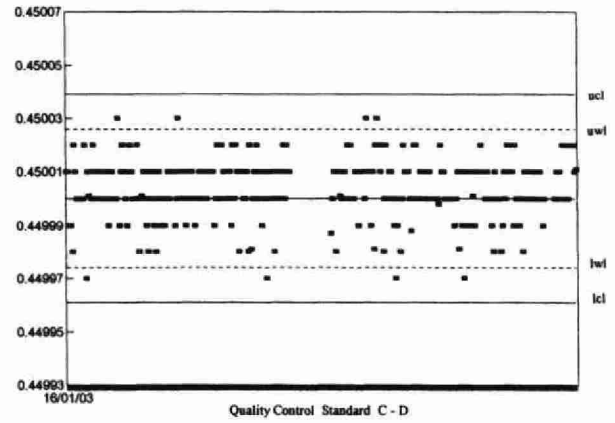
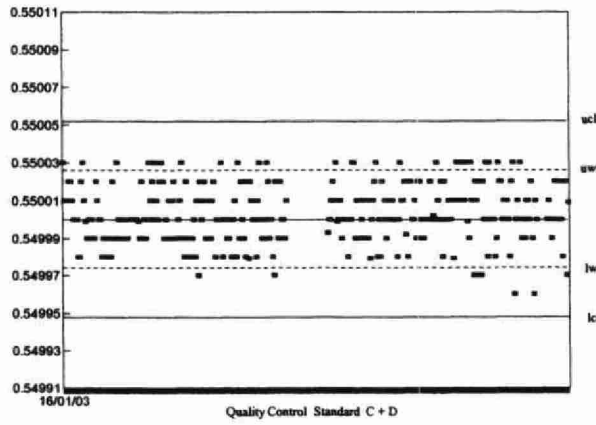
n Data Pairs	Sample Concentration Span (mg/L)	Standard Deviation (2)	Coefficient of variation(%)
393	0 - 5	0.1909	9.7
131	6 - 10	0.4352	6.3
136	11 - 25	0.6694	4.4
99	26 - 100	2.1088	4.1
81	101 - 500	10.1018	4.8
15	501 - 1000	18.7043	2.8
11	1001 - 10000	49.1270	1.9
866	Overall	6.8472	

OTHER CHECKS:

	n	Data Mean (mg/L)	Standard Deviation (1)
Blank	302	-0.08301	0.1709

SOLIDS, SUSPENDED (E3188)

QUALITY CONTROL DATA FROM 01/16/03 TO 12/31/03



SOLIDS, SUSPENDED IGNITED (Particulate Ash and Particulate Loss On Ignition)

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '61
Method Reference No.	E3188	Reporting Unit	mg/L
LIMS Product Code	SIGN3188	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water		

SAMPLING:

Quantity Required	5-500 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

The procedure for particulate solids (SS3188) is followed and the dried residue is ignited at $600 \pm 50^{\circ}\text{C}$ for one hour in a muffle furnace. The dish is transferred to a desiccator to cool. The particulate ash (fixed solids) is the difference between the final ignited mass plus filter and the original tare weight of the filter, divided by the original sample volume (mL) used for SS3188. The particulate loss on ignition (estimate of volatile suspended solids) is the difference between the final ignited mass plus filter and the residue (suspended solids) plus filter, divided by the original sample volume (mL). Data collection, calculations, and transfer of results to LIMS are controlled by a computer system.

INSTRUMENTATION:

Balance (5 decimal places), muffle furnace, filters, Petri dishes
 Computer system with appropriate software

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.5	Current T value: 2.5
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CONTROLS:

Calibration	2 S class weights, e.g. QCA (results in grams)
Drift	Balance is reset to zero after every 10 weighings by the microcomputer.

SOLIDS, SUSPENDED IGNITED (E3188)
(Particulate Ash and Particulate Loss On Ignition)

QUALITY CONTROL DATA FROM 01/09/03 TO 12/19/03

CALIBRATION CONTROL:

	n	Expected Mass (g)	Mean Mass Measured (g)	Mean Bias (g)	Standard Deviation (1)
C:	15	0.50	0.50000	0.00000	0.000011
D:	15	0.05	0.05000	0.00000	0.000006
C+D:		0.55	0.55000	0.00000	0.000013
C-D:		0.45	0.45000	0.00000	0.000012

s.d.(CD) S(between runs): 0.00001 Sw(within run): 0.00001 S/Sw: 1.05

The calibration is accepted if the calibration control values (mean mass measured) obtained lie within the ranges expressed in grams:

0.54995 - 0.55005 for C+D
0.44996 - 0.45004 for C-D

SOLIDS, SUSPENDED IGNITED (PARTICULATE ASH)**DUPLICATES:**

n Data Pairs	Sample Concentration Span (mg/L)	Standard Deviation (2)	Coefficient of variation(%)
21	0 - 100.0	1.8003	6.7
10	100.1 - 500.0	13.0650	2.2
5	500.1 - 1000.0	25.3468	3.9
1	1000.1 - 5000.0	N.A.	N.A.
37	Overall	11.9682	

OTHER CHECKS:

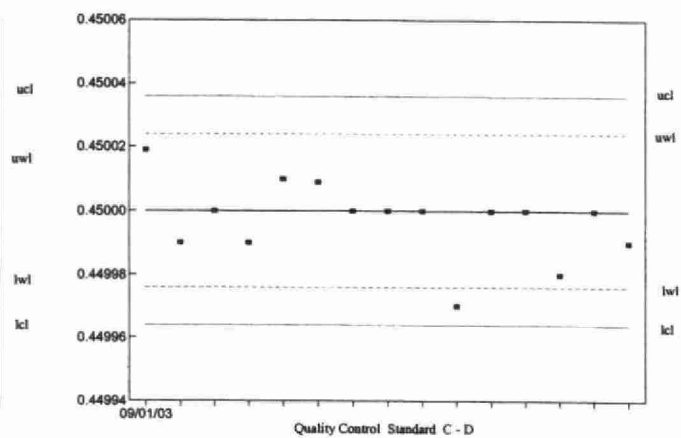
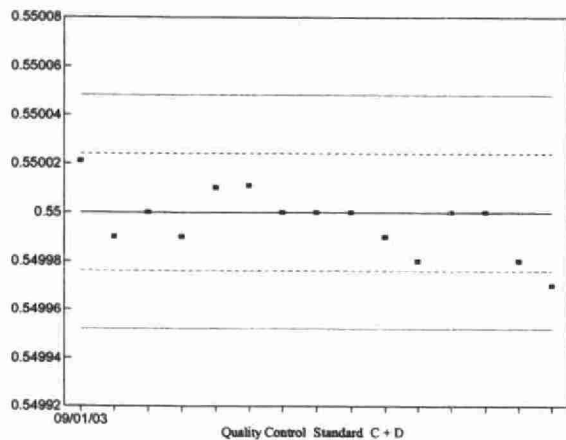
	n	Data Mean (mg/L)	Standard Deviation (1)
Blank	15	-0.11	0.4566

SOLIDS, SUSPENDED IGNITED (PARTICULATE LOSS ON IGNITION)**DUPLICATES:**

n Data Pairs	Sample Concentration Span (mg/L)	Standard Deviation (2)	Coefficient of variation(%)
30	0 - 50.0	0.9352	7.6
5	50.1 - 100.0	8.8481	13.4
2	100.1 - 1000.0	10.4000	7.6
0	1000.1 - 5000.0	N.A.	N.A.
37	Overall	4.1395	

Solids, Suspended Ignited (E3188)
(Particulate Ash and Particulate Loss on Ignition)

QUALITY CONTROL DATA FROM 01/09/03 TO 12/19/03



SOLIDS, TOTAL

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '81
Method Reference No.	E3188	Reporting Unit	mg/L or mg/Kg
LIMS Product Code	TS3188	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water, Surface Water, Drinking Water, Ground Water, Leachate		

SAMPLING:

Quantity Required	125 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Generally, 100 mL aliquot of sample (alternate 50 mL) is pipetted into a preweighed Teflon dish, dried at 103-105°C, and stored in a desiccator for at least 24 hours. The total residue or solids content is calculated by subtracting the original dish mass from the dried dish mass. Data collection, calculations, and transfer of results to LIMS are controlled by a computer system.

INSTRUMENTATION:

Balance (5 decimal places), drying oven, dishes (Teflon).
Computer system with appropriate software.

REPORTING:

Maximum Significant Figures: 3	Current W value: 2.0	Current T value: 10
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CALIBRATION:

Balance zero
Balance internal calibration performed daily.

CONTROLS:

Calibration	2 S class weights, e.g. QCA (results in grams)
Drift	Balance is reset to zero after every 10 weighings by the microcomputer.
Recovery	2 standards, e.g. R1

SOLIDS, TOTAL (E3188)

QUALITY CONTROL DATA FROM 01/21/03 TO 12/11/03

CALIBRATION CONTROL: (QC data from TS3188)

	n	Expected Mass (g)	Mean Mass Measured (g)	Mean Bias (g)	Standard Deviation (1)
A:	7	50.00	50.0001	0.0001	0.00005
B:	7	30.00	30.0001	0.0001	0.00004
A+B:		80.00	80.0002	0.0002	0.00008
A-B:		20.00	19.9999	-0.0001	0.00005

s.d.(AB) S(between runs): 0.00005 Sw(within run): 0.00004 S/Sw: 1.22

The calibration is accepted if the calibration control values (mean mass measured) obtained lie within the ranges expressed in grams:

79.9997 - 80.0005 for A+B
19.9997 - 20.0003 for A-B

RECOVERIES:

Number of Data	Expected Concentration (mg/L)	Mean Concentration Measured (mg/L)	Standard Deviation (1)
7	20000.0	20070.97	77.7176
6	2000.0	1994.17	11.4091

DUPLICATES:

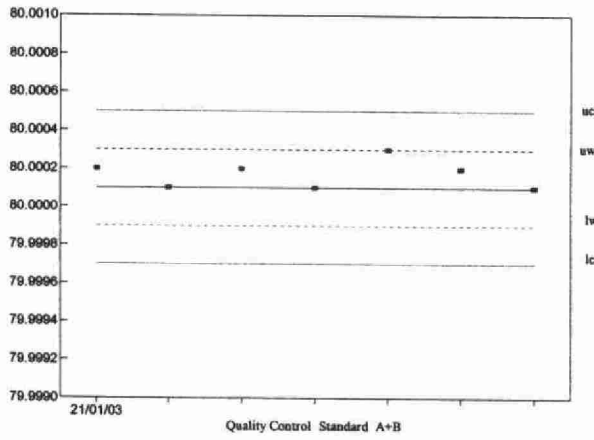
n Data Pairs	Sample Concentration Span (mg/L)	Standard Deviation (2)	Coefficient of variation(%)
3	0 - 6000	20.5281	2.3
6	6001 - 25000	200.8123	1.3
5	25001 - 50000	232.3667	0.7
14	Overall	191.4585	

OTHER CHECKS:

	n	Data Mean (mg/L)	Standard Deviation (1)
Blank	6	1.21	4.6261

SOLIDS, TOTAL (E3188)

Quality Control Data From 01/21/03 To 12/11/03



SOLIDS, TOTAL IGNITED
(Ash and Loss On Ignition)

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before '61
Method Reference No.	E3188	Reporting Unit	mg/L
LIMS Product Code	TIGN3188	Supervisor	P. Wilson
Sample Type/Matrix	Sludge, Effluent, Raw Sewage, Industrial Waste, Process Water		

SAMPLING:

Quantity Required	5-500 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

The procedure for total solids (TS3188) is followed and the dried residue is ignited at $600 \pm 50^{\circ}\text{C}$ for one hour in a muffle furnace. The dish is transferred to a desiccator to cool. The ash (fixed solids) is the difference between the final ignited mass plus filter and the original tare weight of the filter, divided by the original sample volume (mL) used for TS3188. The loss on ignition (estimate of volatile total solids) is the difference between the final ignited mass plus filter and the residue (total solids) plus filter, divided by the original sample volume (mL). Data collection, calculations, and transfer of results to LIMS are controlled by a computer system.

INSTRUMENTATION:

Balance (5 decimal places), muffle furnace, filters, Petri dishes.
Computer system with appropriate software.

REPORTING:

Maximum Significant Figures: 3	Current W value: 2.0	Current T value: 10
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CONTROLS:

Calibration	2 S class weights, e.g. QCA (results in grams)
Drift	Balance is reset to zero after every 10 weighings by the microcomputer.

SOLIDS, TOTAL IGNITED (E3188)
(Ash and Loss On Ignition)
 QUALITY CONTROL DATA FROM 01/08/02 TO 09/02/03

CALIBRATION CONTROL:

	n	Expected Mass (g)	Mean Mass Measured (g)	Mean Bias (g)	Standard Deviation (1)
A:	15	50.00	50.0005	0.0005	0.00015
B:	15	30.00	30.0003	0.0003	0.00010
A+B:		80.00	80.0009	0.0009	0.00025
A-B:		20.00	20.0002	0.0002	0.00009

s.d.(AB) S(between runs): 0.00013 Sw(within run): 0.00006 S/Sw: 2.14

The calibration is accepted if the calibration control values (mean mass measured) obtained lie within the ranges expressed in grams:

for 2002

80.0007 - 80.0011 for A+B
 20 - 20.0004 for A-B

for 2003

79.9997 - 80.0005 for A+B
 19.9999 - 20.0003 for A-B

SOLIDS, TOTAL IGNITED (DRY)

RECOVERIES:

Number of Data	Expected Concentration (mg/L)	Mean Concentration Measured (mg/L)	Standard Deviation (1)
15	20000.0	20135.05	140.52
15	2000.0	2004.58	13.77

DUPLICATES:

n Data Pairs	Sample Concentration Span (mg/L)	Standard Deviation (2)	Coefficient of variation(%)
2	0 - 10000	N.A.	N.A.
4	10001 - 15000	247.85	1.9
5	15001 - 25000	170.03	0.8
12	25001 - 50000	370.47	1.0
23	Overall	304.45	

**SOLIDS, TOTAL IGNITED cont'd
(Ash and Loss On Ignition)**

SOLIDS, TOTAL IGNITED (ASH)

DUPLICATES:

n Data Pairs	Sample Concentration Span (mg/L)	Standard Deviation (2)	Coefficient of variation(%)
7	0 - 5000	28.48	0.6
9	5001 - 15000	67.04	0.6
7	150001 - 25000	171.86	0.8
23	Overall	104.86	

OTHER CHECKS:

Ashed	n	Data Mean (mg/L)	Standard Deviation (1)
Blank	15	1.0727	6.2864

SOLIDS, TOTAL IGNITED (LOSS ON IGNITION)

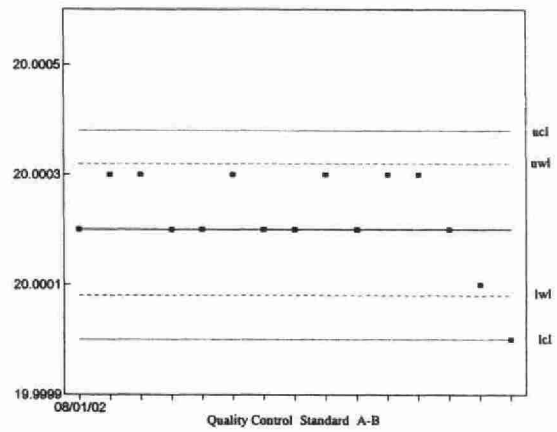
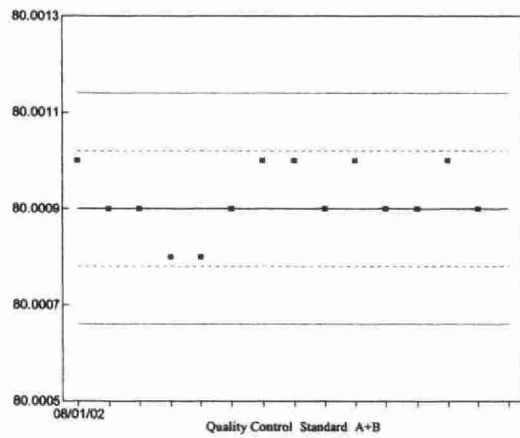
DUPLICATES:

n Data Pairs	Sample Concentration Span (mg/L)	Standard Deviation (2)	Coefficient of variation(%)
1	0 - 5000	N.A.	N.A.
12	5001 - 15000	209.37	2.1
10	15001 - 25000	239.60	1.2
2	25001 - 50000	N.A.	N.A.
25	Overall	219.69	

OTHER CHECKS:

LOI	n	Data Mean (mg/L)	Standard Deviation (1)
Blank	1	N.A.	N.A.

Quality Control Data From 01/08/02 To 09/02/03



SULPHATE

IDENTIFICATION:

Laboratory Unit	Water Chemistry	Method Introduced	01/04/78
Method Reference No.	E3004	Units	$\mu\text{g}/\text{m}^3$ as SO_4
LIMS Product Code	ANION3004	Supervisor	P. Wilson
Sample Type/Matrix	Air; HiVol Glass Fibre, Quartz and Polyflon, Other Filters and Puff		

SAMPLING:

Quantity Required	3/4" or 1.9cm strip from 8"x10" filter
Container	50 mL polypropylene tube

SAMPLING PREPARATION:

A 3/4" strip is cut in pieces and deposited into a 50 mL polypropylene tube. 50 mL of Pure-Water is added to the tube. The tube is placed on a horizontal shaker for approximately 1 hour. The supernatant is then filtered into a 15 mL plastic tube and analysed.

ANALYTICAL PROCEDURE:

Sulphate separated from other anions in the sample by automated suppressed ion chromatography using an eluent mixture of sodium bicarbonate and sodium carbonate and a conductivity detector. The concentration of sulphate (mg/L) is determined by the comparison of the analyte peak area count to that of a series of standards. The analyte result is corrected for the filter blank before the final calculation is made. The result is reported as $\mu\text{g}/\text{m}^3$ as SO_4 .

Chloride and nitrate are determined simultaneously.

INSTRUMENTATION:

Horizontal Shaker, ion chromatographic system plus a PC with ChromPerfect software and DT2804 card for automated sample injection, timing, and data processing.

REPORTING:

Maximum Significant Figures: 3	Current W value: $0.1 \mu\text{g}/\text{m}^3$	Current T value: $0.5 \mu\text{g}/\text{m}^3$
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CALIBRATION:

6 standards

CONTROLS:

Calibration	MB, IS(n), CS1, CS2, QCA and QCB
Drift	Duplicate plus 2 standards approximately every 20 samples
Recovery	CS3, CS4 & CS5

Note: IS(n) calibration controls were discontinued on August 15, 2003.
CS3 recovery control was discontinued on February, 2003.
QCA & QCB are put on line since June, 2003.

NOTES:

To convert unit from mg/L to $\mu\text{g}/\text{m}^3$, the final concentration of SO_4 in mg/L is multiplied by the following formula:

$$\text{Result (mg/L)} \times 50\text{mL} \times (63/6.75) / \text{air volume} = \mu\text{g}/\text{m}^3$$

where: 63 is the area of the filter exposed and 6.75 is the sample aliquot area in square inch.

SULFATE (E3004)

QUALITY CONTROL DATA FOR 06/25/03 TO 12/11/03

Analytical Range: to 100 mg/L

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	25	80	80.512	0.512	0.3649
B:	25	20	20.135	0.135	0.1358
A+B:		100	100.647	0.647	0.4137
A-B:		60	60.377	0.377	0.3635

s.d.(AB) S(between runs): 0.28

Sw(within run): 0.26

S/Sw: 1.07

On any given day the calibration is accepted if the values obtained lie within the ranges:

99.16	-	102.13	for	A+B
59.26	-	61.49	for	A-B

Certified Reference standard data for 01/03/03 to 08/06/03:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
IS1	41	13.13	12.94	-0.19	0.0972
IS2	41	11.95	11.87	-0.08	0.1250
IS3	41	32.13	32.01	-0.12	0.1437
IS4	41	89.56	89.59	0.03	0.5817

The standards are accepted if the control values obtained lie within the ranges:

12.18	-	14.08	for	IS1
11.24	-	12.66	for	IS2
31.28	-	32.98	for	IS3
85.25	-	93.87	for	IS4

In House Control standard data for 01/08/03 to 11/27/03:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
CS4	36	40.30	41.44	1.14	0.4973
CS5	36	34.67	34.68	0.01	0.3442

The standards are accepted if the control values obtained lie within the ranges:

35.86 - 44.74 for CS4
33.64 - 35.73 for CS5

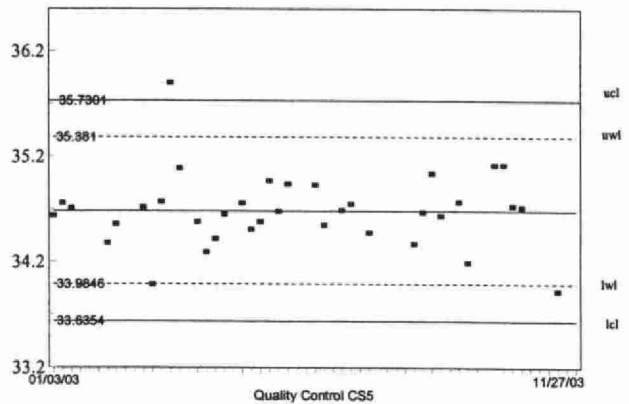
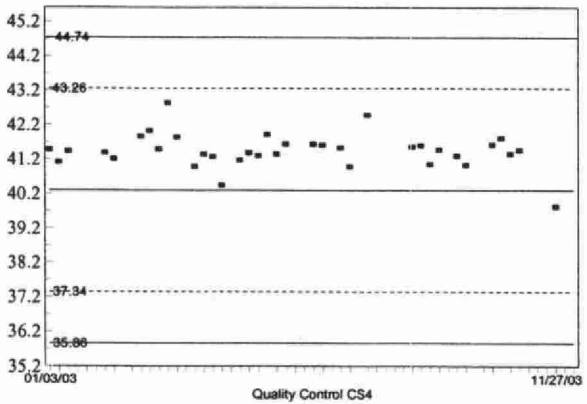
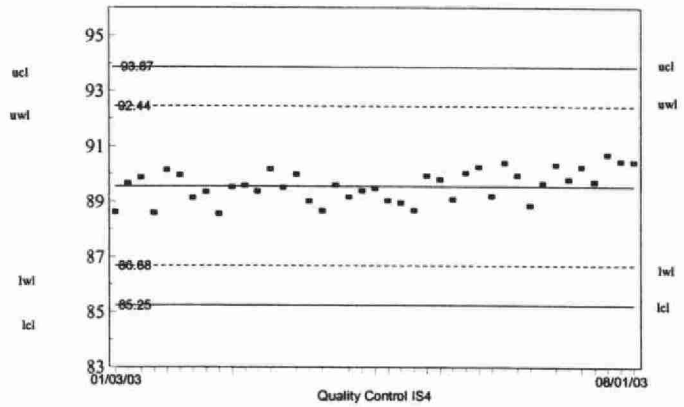
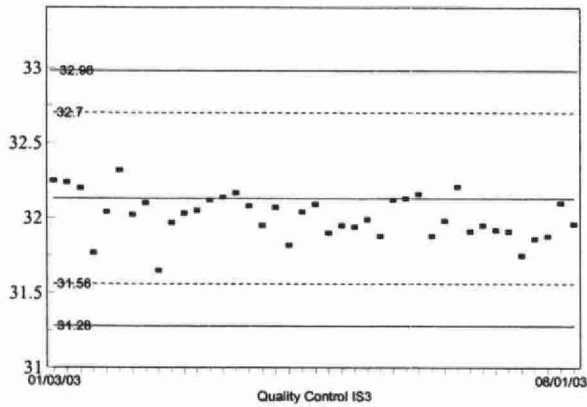
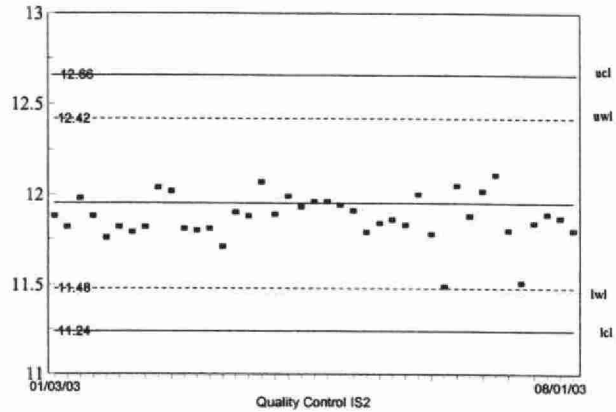
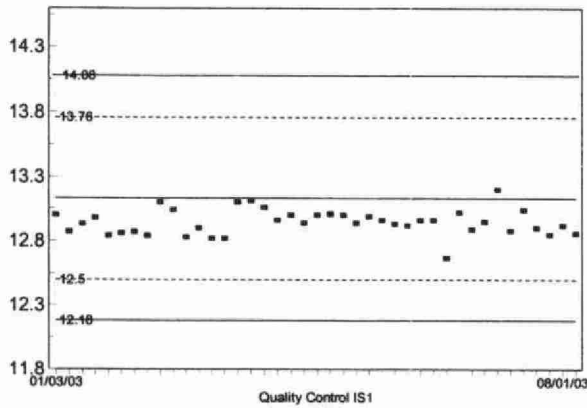
DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
41	0.00 - 2.86	0.0442	2.9
24	2.89 - 7.15	0.0842	1.9
14	7.18 - 14.31	0.2405	2.1
15	14.33 - 28.61	0.3125	1.6
94	Overall	0.1639	

SULPHATE (E3004)

QUALITY CONTROL DATA FROM 01/03/03 TO 11/27/03

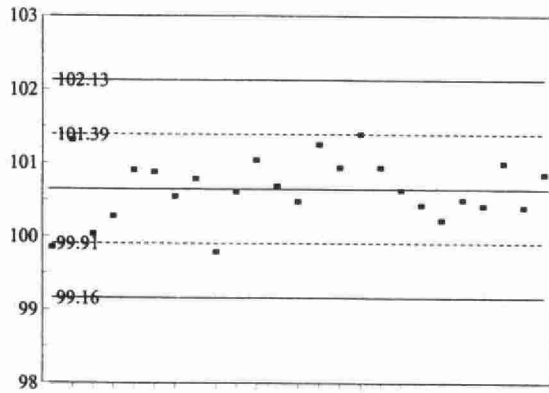
Analytical Range For IS Controls: to 100 mg/L
Analytical Range For CS Controls: to 28.61 $\mu\text{g}/\text{m}^3$



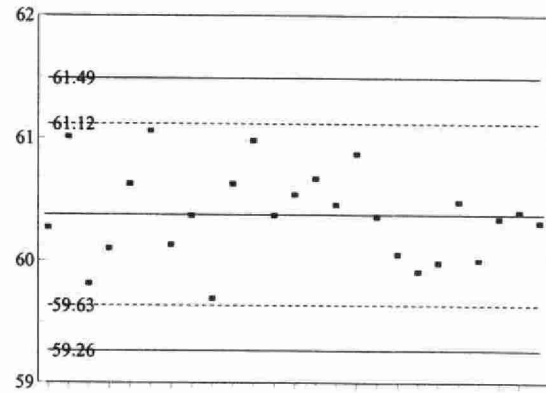
SULPHATE (E3004)

QUALITY CONTROL DATA FROM 06/25/03 TO 12/11/03

Analytical Range: to 100 mg/L



Quality Control Standard A + B



Quality Control Standard A - B

SULPHATE

IDENTIFICATION:

Laboratory Unit	Water Chemistry	Method Introduced	01/01/86
Method Reference No.	E3013	Units	µg/g as SO ₄
LIMS Product Code	ANION3013, SUL3013	Supervisor	P. Wilson
Sample Type/Matrix	Soil and Sediment		

SAMPLING:

Quantity Required	20 g
Container	glass or plastic

SAMPLING PREPARATION:

A 3.0 g sample air dried, sieved soil or air dried sieved and ground sediment is placed in a 50 mL centrifuge tube and shaken with 30 mL Pure-DW for 1 hour on a shaker. Samples are centrifuged, membrane filtered and analyzed for chloride and sulphate by ion chromatography.

ANALYTICAL PROCEDURE:

Sulphate separated from other anions in the sample by automated suppressed ion chromatography using an eluent mixture of sodium bicarbonate and sodium carbonate and a conductivity detector. The concentration of sulphate (mg/L) is determined by the comparison of the analyte peak area count to those of a series of standards. The result is reported as µg/g as SO₄.

Chloride is determined simultaneously.

INSTRUMENTATION:

Horizontal Shaker, ion chromatographic system plus a PC with ChromPerfect software and DT2804 card for automated sample injection, timing, and data processing.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.5 µg/g	Current T value: 2.5 µg/g
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CALIBRATION:

8 standards

CONTROLS:

Calibration	MB, IS(n), CS1, CS2, QCA and QCB
Drift	Duplicate plus 2 standards approximately every 20 samples

Note: IS(n) calibration controls were discontinued on August 15, 2003.
QCA & QCB are put on line since June, 2003.

SULFATE (E3013)

QUALITY CONTROL DATA FOR 2003

Analytical Range: to 1000 µg/g

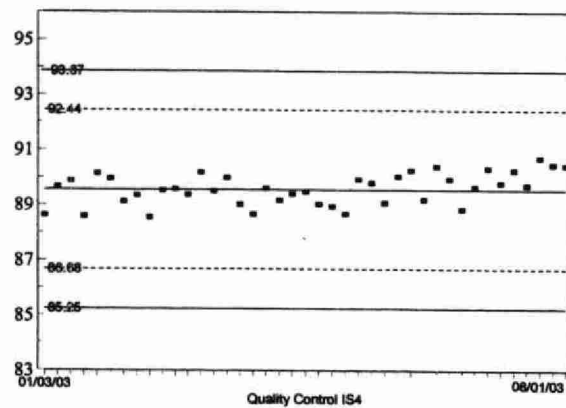
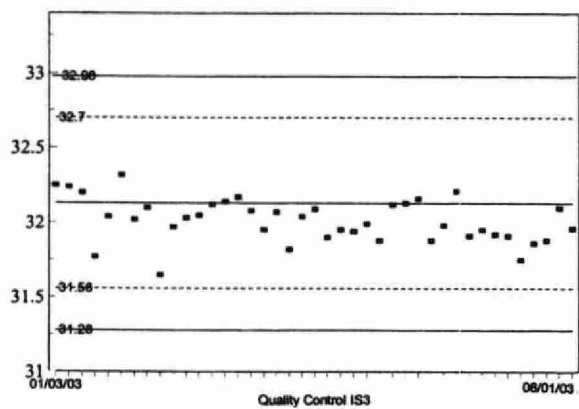
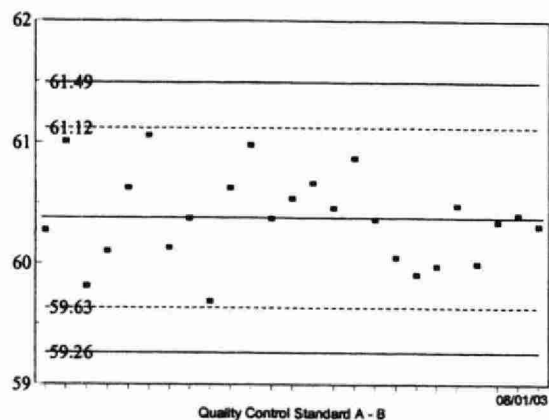
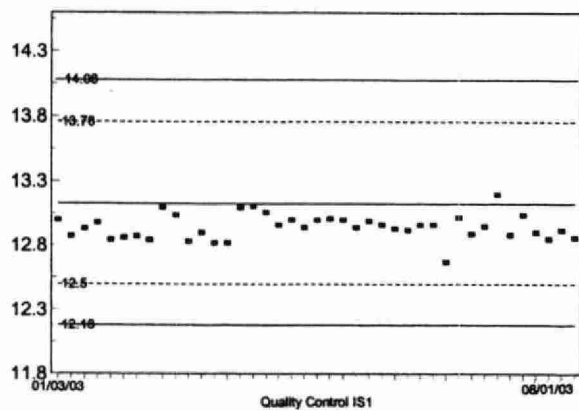
DUPLICATES:

n Data Pairs	Sample Concentration Span (µg/g)	Standard Deviation (2)	Coefficient of variation(%)
13	0.00 - 200	1.7732	1.9
6	201 - 500	6.0436	1.8
2	501 - 1000	5.3852	0.9
21	Overall	3.8915	

SULPHATE (E3013)

QUALITY CONTROL DATA FROM 01/03/03 TO 08/16/03

Analytical Range For IS Controls: to 100 mg/L



SULPHATE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	04/01/82
Method Reference No.	E3172	Reporting Unit	mg/L as SO ₄
LIMS Product Code	SULP3172, Anion3172	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water, Surface Water, Ground Water, Leachates, Effluent, Industrial Waste, Raw Sewage		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Sulphate is separated from other anions in the samples by automated suppressed ion chromatography using an eluent mixture of 0.001 M sodium bicarbonate and 0.0035 M sodium carbonate with conductivity detection. The concentration of sulphate in mg/L as SO₄ is determined by comparison of the sample scan to a series of standard scans.

INSTRUMENTATION:

Basic modular continuous flow ion chromatographic system, Justice Innovation ChromPerfect Spirit Data Station, plus control module (in-house design) for automated sample introduction, timing and detector range switching.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.5	Current T value: 2.5
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CALIBRATION:

BL plus 9 standards

CONTROLS:

Calibration	LTBL plus 3 standards, e.g. QCA
Drift	CHK1 and CHK2 standard approximately every 20 samples

SULPHATE (E3172)

QUALITY CONTROL DATA FROM 01/06/03 TO 12/22/03

Analytical Range: to 100.0 mg/L as SO₄

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	100	80.0	80.29	0.29	0.38
B:	100	40.0	40.32	0.32	0.22
C:	100	8.0	7.94	-0.06	0.08
A+B:		120.0	120.61	0.61	0.55
A-B:		40.0	39.97	-0.03	0.31
B+C:		48.0	48.26	0.26	0.28
B-C:		32.0	32.39	0.39	0.19

s.d.(AB) S(between runs): 0.31 Sw(within run): 0.22 S/Sw: 1.45
s.d.(BC) S(between runs): 0.17 Sw(within run): 0.13 S/Sw: 1.24

The calibration is accepted if the calibration control values obtained lie within the ranges:

118.4 - 121.65 for A+B
38.76 - 41.24 for A-B
46.95 - 49.05 for B+C
31.21 - 32.79 for B-C

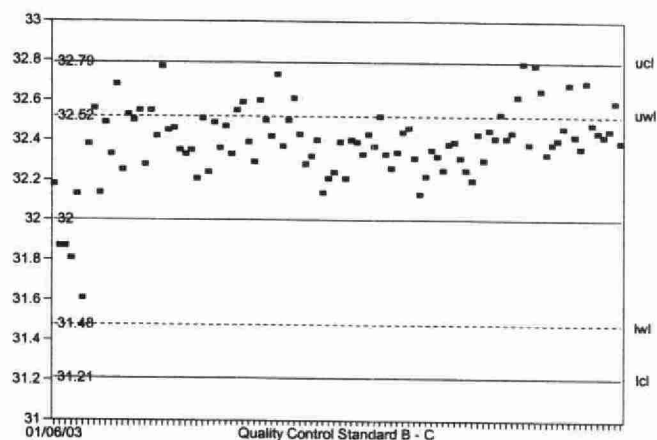
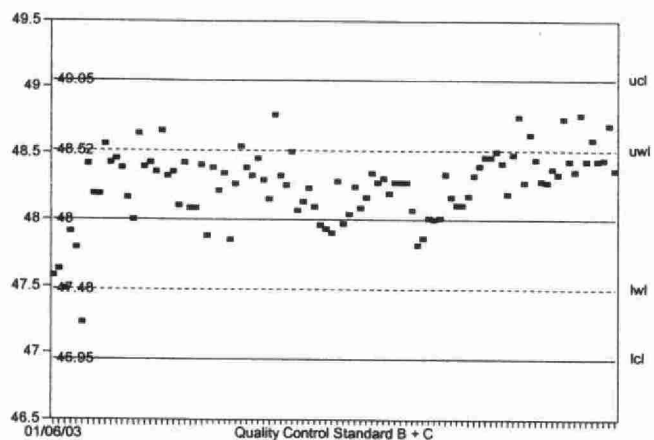
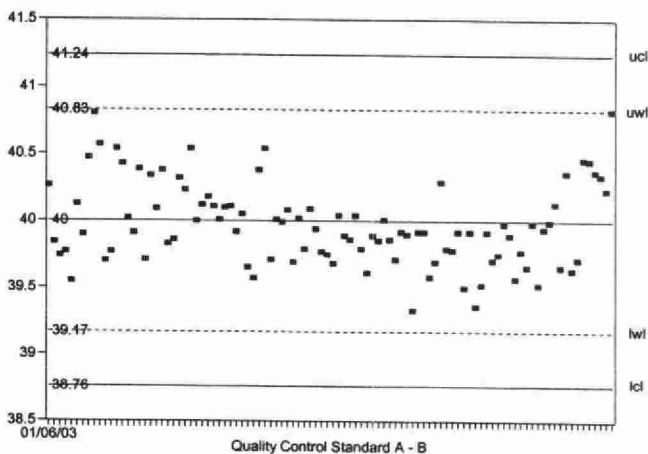
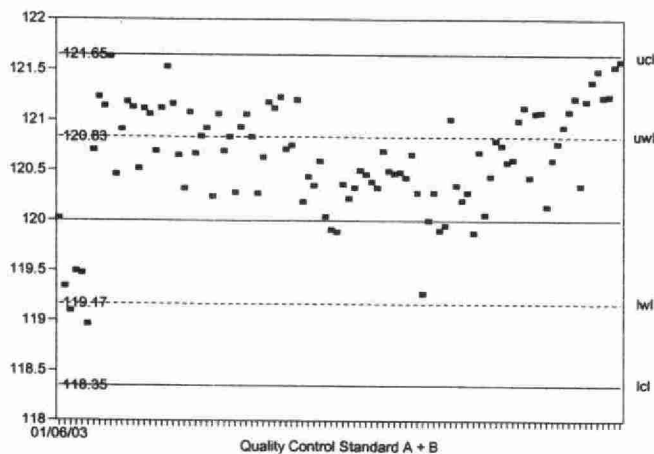
DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
44	0.0 - 10.0	0.0901	1.8
64	10.1 - 20.0	0.2443	1.6
113	20.1 - 50.0	0.3983	1.3
52	50.1 - 100.0	0.7490	1.1
273	Overall	0.4341	

SULPHATE (E3172)

QUALITY CONTROL DATA FROM 01/06/03 TO 12/22/03

Analytical Range: to 100.0 mg/L as SO₄



SULPHIDE

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	June 89
Method Reference No.	E3100	Reporting Unit	µg/L as S ²⁻
LIMS Product Code	H2S3100	Supervisor	P.Wilson
Sample Type/Matrix	Drinking Water, Surface Water, Ground Water, Leachates, Effluent, Industrial Waste, Raw Sewage		

SAMPLING:

Quantity Required	50 mL
Container	Glass or plastic

ANALYTICAL PROCEDURE:

Total Sulphide (H₂S, HS⁻ and any acid soluble metal sulphides) have been precipitated as ZnS during sample preservation. The precipitated sulphides (hydrogen sulphides) are dissolved in an alkaline absorbing solution and reacted with N,N-dimethyl-p-phenylenediamine dihydrochloride and ferric chloride to form methylene blue. The intensity of the methylene blue is compared to standards treated in the same manner.

INSTRUMENTATION:

Basic automated modular continuous flow colourimetric system, measurement through a 660 nm filter and a 50 mm flow cell (1.5mm ID).

REPORTING:

Maximum Significant Figures: 3	Current W value: 2.0 µg/L	Current T value: 10.0 µg/L
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CALIBRATION:

BL plus 5 standards

CONTROLS:

Calibration	Daily blank and 3 standards, e.g. QCA
Drift	Blank and sensitivity check standard approximately every 10 samples

SULPHIDE (E3100)

QUALITY CONTROL DATA FROM 02/28/01 TO 11/19/03

Analytical Range: to 100.0 µg/L as S²⁻

CALIBRATION CONTROL:

	n	Expected Concentration	Mean Concentration	Mean Bias	Standard Deviation (1)
A:	33	128	125.98	-2.02	11.22
B:	33	80	81.29	1.29	10.15
C:	33	32	31.89	-0.11	8.65
A+B:		208	207.27	-0.73	19.69
A-B:		48	44.69	-3.31	7.92
B+C:		112	113.18	1.18	15.99
B-C:		48	49.40	1.40	9.98

s.d.(AB) S(between runs): 10.70

s.d.(BC) S(between runs): 9.43

Sw(within run): 5.60

Sw(within run): 7.06

S/Sw: 1.9

S/Sw: 1.3

The calibration is accepted if the calibration control values obtained lie within the ranges:

179.2	-	236.8	for	A+B
26.4	-	69.6	for	A-B
62.3	-	161.7	for	B+C
10.7	-	85.3	for	B-C

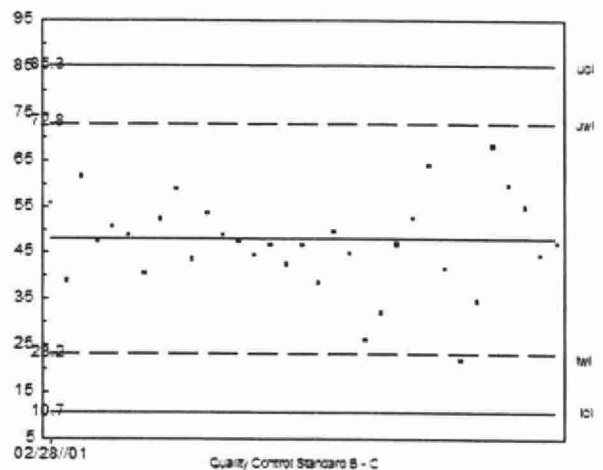
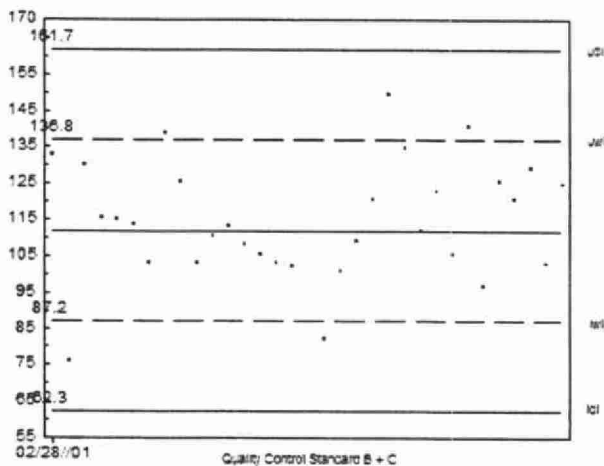
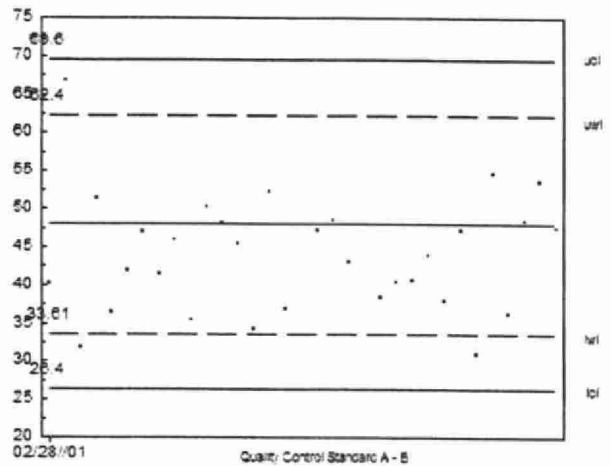
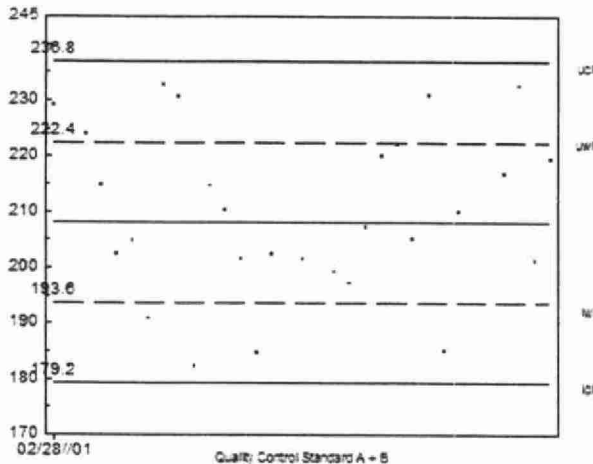
DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
42	0.0 - 32.0	0.9654	8.24
9	32.1 - 80.0	3.0512	5.09
22	80.1 - 160.0	1.5767	1.69
73	Overall	1.5599	

SULPHIDE (E3100)

QUALITY CONTROL DATA FROM 02/28/01 TO 11/19/03

Analytical Range: to 100.0 µg/L as S²⁻



Note: For explanation of any exceedence, refer to raw data file.

TURBIDITY

IDENTIFICATION:

Laboratory	Water Chemistry	Method Introduced	Before'74
Method Reference No.	E3311	Reporting Unit	FTU
LIMS Product Code	TURB3311	Supervisor	P. Wilson
Sample Type/Matrix	Surface Water, Ground Water, Effluent, Drinking Water, Industrial Waste, Process Water, Leachate		

SAMPLING:

Quantity Required:	50 mL
Container:	Glass or plastic

ANALYTICAL PROCEDURE:

The instrument is standardized with sealed standards which are prepared commercially and rated in Formazin Turbidity Units. Samples are placed in the turbidimeter, and results in FTU are read directly from the digital output. Turbidity measurements are based on light scattering at 90° (±30°) rotation. The instrument compensates for sample colour.

INSTRUMENTATION:

-Hach Ratio/XR Model Turbidimeter modified to accept control signals from robot controller, electronic interface, Zymark ZYMATE 11 Laboratory Robot System and computer.

REPORTING:

Maximum Significant Figures: 3	Current W value: 0.05	Current T value: 0.25
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CALIBRATION:

BL plus formazin standards (once every four months). Calculated QC limits are specific to each standard set.

CONTROLS:

Calibration:	5 standards, e.g. QCA
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NOTES: QCA and QCD data for June 4th and 18th are outside the limits respectively. Samples were repeated in their respective range.

TURBIDITY (E3311)
QUALITY CONTROL DATA FROM 01/03/03 TO 12/30/03

Analytical Range: to 2000 FTU

CALIBRATION CONTROL:

January to December:

	n	Expected Concentration	Mean Concentration	Standard Deviation (1)
A:	216	2.0	1.1024	0.0211
B:	216	20.0	16.3084	0.4757
C:	216	200.0	185.3431	1.9717
D:	216	2000.0	1576.634	10.5461

On any given day the calibration is accepted if the values obtained lie within the ranges:

1.0679	-	1.1332	for	A (Jan - Jun)
1.0574	-	1.1304		A (Jul - Sep)
1.0832	-	1.1520		A (Sep - Dec)
15.4371	-	16.1296	for	B (Jan - Jun)
15.6239	-	16.8714		B (Jul - Sep)
16.5144	-	17.2576		B (Sep - Dec)
180.6761	-	188.3706	for	C (Jan - Jun)
178.9868	-	188.1399		C (Jul - Sep)
181.4949	-	193.3917		C (Sep - Dec)
1564.563	-	1602.37	for	D (Jan - Jun)
1565.469	-	1609.664		D (Jun - Sep)
1541.549	-	1607.718		D (Sep - Dec)

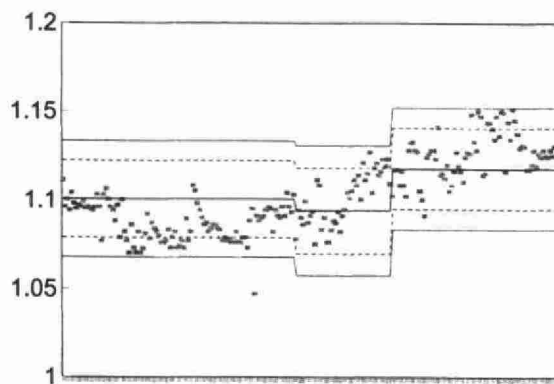
	n	Data Mean	Standard Deviation (1)
Stray Light	216	0.006	0.0029

DUPLICATES:

n Data Pairs	Sample Concentration Span	Standard Deviation (2)	Coefficient of variation(%)
371	0.0 - 2.0	0.0381	7.3
188	2.1 - 20.0	0.3018	5.0
62	21.0 - 200	1.7925	3.2
8	201 - 2000	21.1276	3.6
629	Overall	2.4540	

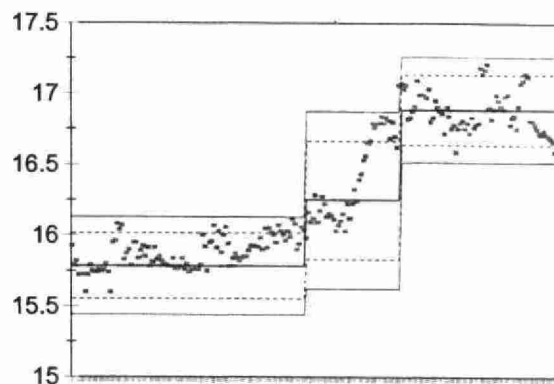
TURBIDITY (E3311)

QUALITY CONTROL DATA FROM 01/03/03 TO 12/30/03
Analytical Range: to 2000 FTU



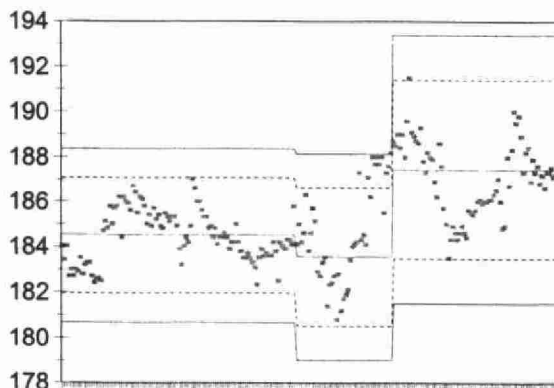
Quality Control Standard A

Jan - Jun Jul - Sep Sep - Dec



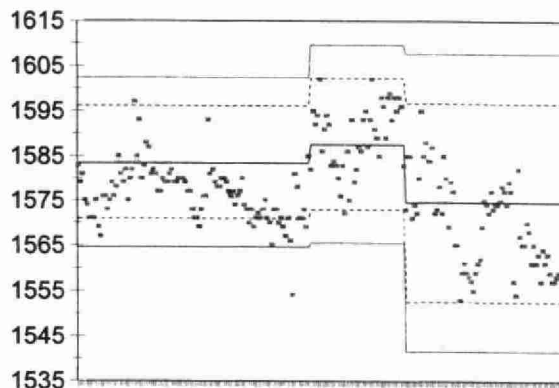
Quality Control Standard B

Jan - Jun Jul - Sep Sep - Dec



Quality Control Standard C

Jan - Jun Jul - Sep Sep - Dec



Quality Control Standard D

Jan - Jun Jul - Sep Sep - Dec

PART 3.0
MICROBIOLOGY

3.1 Quality Control Program, Microbiology Unit

Performance Criteria

Analyses of samples in the Microbiology Unit are performed using validated and accredited (SCC) methodologies, by trained technologists. Quality control measures have been incorporated into the methodologies to ensure that all analytical procedures are functioning properly, minimizing the potential to identify and report false positive or negative results. This report focuses on the quality control implemented during sample analyses. Information regarding the implementation of quality control procedures for sample containers, monitoring of the Pure Water supply, media preparation and storage, equipment monitoring are described by the Laboratory Services Branch (4) and Microbiology Unit Standard Operating Procedures (SOPs), approved Microbiology Methods and Lab Services Branch Quality Assurance Manual (2).

Membrane Filtration

Blank Control Analyses

A control (sterile buffered dilution water) sample is processed between each sample analyzed. The control sample is processed in a manner similar to the regular sample including volume, agar used, incubation time and temperature. The blank control should remain free of any bacterial growth.

Duplicate Analyses

At least one sample in 10 is analyzed in duplicate per day. The data are accumulated for each parameter and a "within-run" standard deviation is calculated to give a measure of the repeatability of the results.

Presence-Absence Procedure

Blank Control Analyses

At least one sample in 10 samples per day includes a blank control sample prepared by adding a 99 mL dilution blank (sterile, buffered dilution water) to P-A broth and incubating it along with the regular P-A bottles. The blank control should remain free of any bacterial growth and there should be no change in the colour of the broth. Identification of growth or colour change in the control blank requires follow-up of sterility checks in both the P-A broth and the dilution blanks.

Heterotrophic Spread Plate

Blank Control Analyses

At least one sample in 10 samples is analyzed per day includes inoculating a Plate Count agar plate with 0.1 mL of sterile buffered dilution water and incubating it along with the regular Plate Count agar plates ($35\pm0.5^{\circ}\text{C}$, 48 ± 3 hours).

Duplicate Analyses

At least one sample in 10 samples is analyzed in duplicate per day. The data are accumulated for each parameter and a "within-run" standard deviation is calculated to give a measure of the repeatability of the results.

Blank Analyses Corrective Action

The presence of bacterial growth on any control sample by the above techniques (Membrane Filtration, PA Broth, Heterotrophic Spread Plate) indicates inaccurate technique. The supervisor must be consulted with regards to determining follow-up and corrective action. Reporting of results may be tempered by the presence of bacterial growth on these control samples and data qualifying remarks codes would be noted on the final report. Records of all control samples are maintained in the laboratory.

3.2 PERFORMANCE SUMMARIES

MICROBIOLOGY

***Escherichia coli* (EC)**

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3226	Reporting Unit	Present/Absent per 100 mL
LIMS Product Code	PA3226	Supervisor	R. Schop
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are added to P-A broth, incubated ($35\pm0.5^{\circ}\text{C}$, for up to 48 ± 3 hours) and checked for growth, gas and acid production. A presumptive positive is identified as the detection of gas and acid production within 48 hours of incubation. Following the identification of a presumptive positive, confirmatory tests for *Escherichia coli* are conducted according to the method.

INSTRUMENTATION:

Micropipette, sterile micropipette tip, sterile graduated cylinder, bunsen burner, incubators, UV lamp

REPORTING:

Present / Absent per 100 mL

CONTROLS:

Analytical	Negative Control(5% per day) -Sterile buffered dilution water
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NOTES:

*PA3226 is used for the detection of EC and TC. Confirmatory testing using ECMug is required.

***Escherichia coli* (EC)**
E3226

QUALITY CONTROL DATA FOR 2003

Present/Absent per 100 mL

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	332	0

***Escherichia coli* (EC)**

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3371	Reporting Unit	CFU per 100 mL
LIMS Product Code	EC3371, *TCEC3371,*ECFS3371 *,ECFSPS3371	Supervisor	R. Schop
Sample Type/Matrix	Sediment, Sludge, Soil, Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water (Raw Water), Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto MFC-BCIG agar plate and incubated 44.5±0.5°C, 24±2 hours. Target colonies (blue) formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, sterile pipets, bunsen burner, incubators, microscope, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable
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CONTROLS:

Analytical	Duplicate samples Blank filter between samples
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NOTES:

* TCEC3371,*ECFS3371*,ECFSPS3371 are mixed parameter product codes. See individual tests TC,FS,PSA, for details on medium used and incubation.

***Escherichia coli* (EC)
E3371**

QUALITY CONTROL DATA FOR 2003

Colony Forming Units/100 mL

DUPLICATES:

n Data Pairs	Counts per Plate CFU/100mL	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
75	1-30*	2.84	2.67	25.10
31	31-75	5.77	4.78	10.48
15	76-150	12.6	9.71	8.73

* 26 duplicates pairs with counts per filter of zero on each, were not included in the statistics

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	2186	0

***Escherichia coli* (EC)**

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1998
Method Reference No.	E3407	Reporting Unit	CFU per 100mL
LIMS Product Code	*TCEC3407	Supervisor	R. Schop
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto DC agar plate and incubated 35±0.5°C, 24±2 hours. Target colonies formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, bunsen burner, incubator, microscope, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable
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CONTROLS:

Analytical	Duplicate samples Blank filter between samples
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NOTES:

*TCEC3407 is a mixed parameter product code. The same medium and incubation time are used to determine both parameters TC and EC.

***Escherichia coli* (EC)
E3407**

QUALITY CONTROL DATA FOR 2003

Colony Forming Units/100 mL

DUPLICATES:

n Data Pairs	Counts per Plate CFU/100mL	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
18	1-30*	2.33	2.38	25.06
7	31-75	3.14	2.64	5.88
0	76-150	N.A.	N.A.	N.A.

* 24 duplicates pairs with counts per filter of zero on each, were not included in the statistics

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	358	0

Fecal Streptococci (FS)

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3371	Reporting Unit	CFU per 100 mL
LIMS Product Code	FS3371,*ECFS3371, *ECFSPS3371	Supervisor	R. Schop
Sample Type/Matrix	Sediment, Sludge, Soil, Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water (Raw Water), Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto mEnterococcus agar plate and incubated 35±0.5°C, 48±3 hours. Target colonies formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, sterile pipets, bunsen burner, incubators, microscope, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable
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CONTROLS:

Analytical	Duplicate samples Blank filter between samples
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NOTES:

ECFS3371,ECFSPS3371 are mixed parameter product codes. See individual tests EC,PSA, for details on medium used and incubation.

**Fecal Streptococci (FS)
E3371**

QUALITY CONTROL DATA FOR 2003

Colony Forming Units/100 mL

DUPLICATES:

(n) Data Pairs	Counts per Plate CFU/100mL	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
38	1-30*	2.74	11.42	91.39
19	31-75	4.79	14.76	30.31
7	76-150	5.43	10.16	9.61

* 2 duplicates pairs with counts per filter of zero on each, were not included in the statistics

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	2186	0

Heterotrophic Plate Count (HPC)

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1998
Method Reference No.	E3408	Reporting Unit	CFU per 1mL
LIMS Product Code	PC3408	Supervisor	R. Schop
Sample Type/Matrix	Drinking Water, Ground Water, Surface Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquot is inoculated onto a Plate Count agar plate with a micropipette. The sample is then spread onto the plate using a glass rod and an electronic turntable. The plate is then incubated $35\pm0.5^{\circ}\text{C}$, 48 ± 3 hours and checked for growth. Target colonies formed on the plate are recorded per 1 mL of sample

INSTRUMENTATION:

Micropipette, sterile micropipette tips, sterile glass rod, electronic turntable, incubator, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable
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CONTROLS:

Analytical	Duplicates Negative control per run- open air plate Negative control (5% per day) - glass rod check
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**Heterotrophic Plate Count (HPC)
E3408**

QUALITY CONTROL DATA FOR 2003

Colony Forming Units/1 mL

DUPLICATES:

n Data Pairs	Counts per Plate CFU/mL	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
103	1 - 30*	2.17	2.02	24.02
35	31 - 75	4.97	4.36	10.60
5	76 -150	11	8.29	8.29

*278 duplicate pairs with counts per plate of zero on each were not included in the statistics

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	599	2

INDICATOR ORGANISMS

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3226	Reporting Unit	Present/Absent per 100 mL
LIMS Product Code	PA3226	Supervisor	R. Schop
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are added to P-A broth and incubated ($35\pm0.5^{\circ}\text{C}$, for up to 48 ± 3 hours) and checked for growth, gas and acid production. A presumptive positive is identified as the detection of gas and acid production within 48 hours of incubation. Following the identification of a presumptive positive, confirmatory tests for indicator organisms are conducted according to the method.

INSTRUMENTATION:

Micropipette, sterile micropipette tip, sterile graduated cylinder, bunsen burner, incubators

REPORTING:

Detected/Not Detected per 100 mL

CONTROLS:

Analytical	Negative Control -Sterile buffered dilution water
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NOTES:

*PA3226 is used for the detection of indicator organisms. Various media are used in their determinations . See method.

***Pseudomonas aeruginosa* (PSA)**

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3371	Reporting Unit	CFU per 100 mL
LIMS Product Code	PSA3371,*ECFSPS3371	Supervisor	R. Schop
Sample Type/Matrix	Sediment, Sludge, Soil, Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water (Raw Water), Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto mPA agar plate and incubated 41.5±0.5°C, 48±3 hours. Target colonies formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, sterile pipets, bunsen burner, incubators, microscope, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable
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CONTROLS:

Analytical	Duplicate samples Blank filter between samples
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NOTES:

*ECFSPS3371 is a mixed parameter product code. See individual test EC, FS for details on medium used and incubation.

***Pseudomonas aeruginosa* (PSA)
E3371**

QUALITY CONTROL DATA FOR 2003

Colony Forming Units/100 mL

DUPLICATES:

Data Pairs (n)	Counts per Plate CFU/100mL	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
36	1-30*	2.14	2.05	33.84
6	31-75	4.33	4.16	8.19
4	76-150	4.5	3.77	4.25

* 24 duplicates pairs with counts per filter of zero on each, were not included in the statistics

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	2186	0

Total Coliforms (TC)

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3226	Reporting Unit	Present/Absent per 100 mL
LIMS Product Code	PA3226	Scientist	R. Schop
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are added to P-A broth and incubated ($35\pm0.5^{\circ}\text{C}$, for up to 48 ± 3 hours) and checked for growth, gas and acid production. A presumptive positive is identified as the detection of gas and acid production within 48 hours of incubation. Following the identification of a presumptive positive, confirmatory tests for Total Coliforms are conducted according to the method.

INSTRUMENTATION:

Micropipette, sterile micropipette tip, sterile graduated cylinder, bunsen burner, incubators, UV lamp

REPORTING:

Present / Absent per 100 mL

CONTROLS:

Analytical	Negative Control -Sterile buffered dilution water
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NOTES:

*PA3226 is used for the detection of EC and TC. Confirmatory testing using ECMug is required.

Total Coliforms (TC)
E3226

QUALITY CONTROL DATA FOR 2003

Present/Absent per 100 mL

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	332	0

Total Coliforms (TC)

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1979
Method Reference No.	E3371	Reporting Unit	CFU per 100 mL
LIMS Product Code	TC3371, *TCEC3371	Supervisor	R. Schop
Sample Type/Matrix	Sediment, Sludge, Soil, Effluent, Industrial Waste, Process Water, Raw Sewage, Drinking Water (Raw Water), Ground Water, Leachate, Precipitation, Surface Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto mEndo LES agar plate and incubated 35±0.5°C, 24±2 hours. Target colonies formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, sterile pipets, bunsen burner, incubators, microscope, Quebec colony counter.

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable
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CONTROLS:

Analytical	Duplicate samples Blank filter between samples
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NOTES:

* TCEC3371 is a mixed parameter product code. See individual test (EC) for details on medium used and incubation.

**Total Coliforms (TC)
E3371**

QUALITY CONTROL DATA FOR 2003

Colony Forming Units/100 mL

DUPLICATES:

Data Pairs	Counts per Plate CFU/100mL	Average of all Data Points	Standard Deviation of the Duplicates	Coefficient of Variation (%)
9	1-30*	6.56	6.64	25.58
19	31-75	5.89	4.97	10.25
5	76-150	10	8.66	8.26

* 1 duplicate pair with counts per filter of zero each, was not included in the statistics

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	2186	0

Total Coliforms (TC)

IDENTIFICATION:

Laboratory	Microbiology	Method Introduced	1998
Method Reference No.	E3407	Reporting Unit	CFU per 100mL
LIMS Product Code	*TCEC3407	Supervisor	R. Schop
Sample Type/Matrix	Drinking Water		

SAMPLING:

Quantity Required:	100 mL
Container:	Plastic, ring sealed
Preservative:	Sodium thiosulphate

ANALYTICAL PROCEDURE:

Sample aliquots are passed through a 0.45 µm pore size, cellulose filter. The membrane filter is then placed onto DC agar plate and incubated 35±0.5°C, 24±2 hours. Target colonies formed on the membrane filter are recorded per 100 mL of sample.

INSTRUMENTATION:

Filtration assembly, sterile membrane filters, sterile graduated cylinders, bunsen burner, incubator, microscope, Quebec colony counter

REPORTING:

Maximum Significant Figures: 2	Current W value: 0	Current T value: Not Applicable
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CONTROLS:

Analytical	Duplicate samples Blank filter between samples
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NOTES:

*TCEC3407 is a mixed parameter product code. The same medium and incubation time are used to determine both parameters TC and EC.

**Total Coliforms (TC)
E3407**

QUALITY CONTROL DATA FOR 2003

Colony Forming Units/100 mL

DUPLICATES:

(n) Data Pairs	Counts per Filter CFU/100mL	Mean Difference	Standard Deviation (2)	Coefficient of Variation (%)
18	1-30*	2.56	2.21	20.62
16	31-75	4.88	3.98	7.91
6	76-150	6.17	6.12	5.22

* 14 duplicates pairs with counts per filter of zero on each, were not included in the statistics

OTHER CHECKS:

	n	number of blanks with growth
Control Blanks	358	0

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ABBREVIATIONS

AAII	- Auto Analyzer Model II
AAS	- Atomic Absorption Spectrophotometer
Bl	- Blank
°C	- Degree Centigrade
cm	- Centimetre
CS1	- Check Sample 1
CS2	- Check Sample 2
CFU	- Colony Forming Units
Date	- Month/Day/Year
DO	- Dissolved Oxygen
EDTA	- Ethylenediaminetetra-Acetic Acid, Disodium Salt, Dihydrate
FTU	- Formazin Turbidity Units
g	- Gram
HZU	- Hazen Units
in ²	- Square Inches
IS(n)	- Internal Standard (n denotes parameter)
kg	- kilogram
L	- Litre
LAB	- Laboratory
LIMS	- Laboratory Information Management System
LTB/L	- Long Term Blank
lcl	- Low Control Limit
lwl	- Low Warning Limit
m ³	- Cubic Metre
M	- Molarity
MB	- Method Blank
meq	- Milliequivalent
mg	- Milligram
min	- Minute
mL	- Millilitre
mm	- Millimetre
N	- Normality
N.A.	- Not Available or Not Applicable
nm	- Nanometre
n	- Number
PC	- Personal Computer
Pure-DW	- Pure Deionized Water

ABBREVIATIONS cont'd

Pure-W	- Pure Water
QC	- Quality Control
QCA	- Quality Control Standard A
QCB	- Quality Control Standard B
QCC	- Quality Control Standard C
QCD	- Quality Control Standard D
R	- Recovery
rpm	- Revolutions Per Minute
RS92	- Reference Standard (in -house)
S	- Between Run Standard Deviation
S ₁	- Standard Deviation (Conventional)
S ₂	- Standard Deviation For Duplicates
S _w	- Standard Deviation Within Run
S. Class	- Weight Classification Designation (not certified)
s.d.	- Standard Deviation
Standard Cal	- Colourimeter setting to control electronic expansion
STD	- Standard
TCU	- True Colour Units
TPTZ	- Ferrous-2,4,6-tri(2'pyridyl)-1,3,5,- triazine
ucl	- Upper Control Limit
uwl	- Upper Warning Limit
µm	- Micrometer
µeq	- Microequivalent
µg	- Microgram
µS	- Micro-Siemen
UV	- Ultra-Violet
V/V	- Concentration based on volume measurements
W40	- Whatman 40 Filters
%	- Percent

Appendix A
W and T values for '02

Parameter	Method Reference No.	Units	Full Scale	W	T
Alkalinity, Total Fixed Endpoint	(E3218)	mg/L CaCO ₃	1000	0.5	2.5
Bromate	(E3434)	µg/L BrO ₃	15	0.2	1.0
Bromide	(E3434)	µg/L Br	30	0.2	1.0
Carbon, Dissolved Inorganic	(E3370)	mg/L C	80.0	0.2	1.0
Carbon, Dissolved Organic	(E3370)	mg/L C	20.0	0.1	0.5
Chloride	(E3004)	µg/m ³ Cl	28.6	0.1	0.5
Chloride	(E3013)	µg/g Cl	-	0.5	2.5
Chloride	(E3016)	mg/L Cl	100	0.2	1.0
Chlorophyll "a"	(E3169)	µg/L	-	0.2	1.0
Chlorophyll "a" Acidified	(E3169)	µg/L	-	1.0	5.0
Chlorophyll "b"	(E3169)	µg/L	-	0.1	0.5
Colour, True	(E3219)	TCU	100	0.2	1.0
Conductivity	(E3218)	µS/cm	2000	1	5
Cyanide, Free	(E3015)	mg/L CN ⁻	0.2	0.001	0.005
		µg/g CN ⁻		0.01	0.05
Cyanide, Total	(E3015)	mg/L CN ⁻	0.2	0.001	0.005
Cyanide, Total	(E3015)	µg/g CN ⁻		0.01	0.05
Fluoride	(E3172)	mg/L F	2.0	0.01	0.05
Nitrate	(E3004)	µg/m ³ NO ₃	28.6	0.1	0.5
Nitrilotriacetic Acid	(E3406)	mg/L NTA	1.00	0.01	0.05
Nitrogen,					
Ammonia Plus Ammonium	(E3364)	mg/L N	2.0	0.002	0.01
Ammonia Plus Ammonium	(E3366)	mg/L N	50.0	0.05	0.25
Nitrogen, Nitrate Plus Nitrite	(E3364)	mg/L N	5.00	0.005	0.025
Nitrogen, Nitrate Plus Nitrite	(E3366)	mg/L N	50.0	0.05	0.25
Nitrogen, Nitrite	(E3364)	mg/L N	0.200	0.001	0.005

Appendix A
W and T values for '02

Parameter	Method Reference No.	Units	Full Scale	W	T
Nitrogen, Nitrite	(E3366)	mg/L N	2.00	0.005	0.025
Nitrogen, Total Kjeldahl	(E3116)	mg/g N	20	0.1	0.5
Nitrogen, Total Kjeldahl	(E3118)	mg/g N	100	0.20	1.00
Nitrogen, Total Kjeldahl	(E3367)	mg/L N	2.00	0.02	0.10
Nitrogen, Total Kjeldahl	(E3368)	mg/L N	50.0	0.05	0.25
Oxygen Demand, Biochemical	(E3182)	mg/L O	9.0	0.2	1
Oxygen Demand, Chemical	(E3170)	mg/L O	50	1	5
Oxygen Demand, Chemical	(E3246)	mg/L O	400	2	10
pH	(E3218)	-	-	-	-
Phenolics, Reactive	(E3179)	µg/L Phenol	50.0	0.2	1.0
Phosphorus,					
Reactive ortho-Phosphate	(E3364)	mg/L P	0.100	0.0005	0.0025
Reactive ortho-Phosphate	(E3366)	mg/L P	10.0	0.02	0.10
Phosphorus, Total	(E3116)	mg/g P	2	0.02	0.10
Phosphorus, Total	(E3118)	mg/g P	25	0.02	0.10
Phosphorus, Total	(E3367)	mg/L P	0.200	0.002	0.01
Phosphorus, Total	(E3368)	mg/L P	10.0	0.02	0.10
Silicon, Reactive Silicates	(E3370)	mg/L Si	10.0	0.02	0.10
Solids, Dissolved	(E3188)	mg/L	-	2	10
Solids, Suspended	(E3188)	mg/L	-	0.5	2.5
Solids, Suspended Ignited	(E3188)	mg/L	-	0.5	2.5
Solids, Total	(E3188)	mg/L	-	2.0	10.0
Solids, Total Ignited	(E3188)	mg/L	-	2.0	10.0
Sulphate	(E3004)	µg/m ³ SO ₄	28.6	0.1	0.5
Sulphate	(E3013)	µg/g	1000	0.5	2.5
Sulphate	(E3172)	mg/L SO ₄	100	0.5	2.5

Appendix A
W and T values for '02

Parameter	Method Reference No.	Units	Full Scale	W	T
Sulphide	(E3100)	$\mu\text{g/L S}^{2-}$	100	2.0	10.0
Turbidity	(E3311)	FTU	2000	0.05	0.25



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TD/380/P47/2003/MOE

TD/380/P47/2003/MOE

Wong, Priscilla

Performance report

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